APRIL 1926—THIRTY-SECOND YEAR

MACHINERY

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The British Metal-working Industries

From MACHINERY's Special Correspondent

London, March 17

THE engineering industry continues its steady revival, and it is now the exception, in any branch of the metal-working industry, to hear pessimistic comments as to the future. Manufacturing firms showing enterprise in production or design are deriving the most benefit from the general improvement.

The Machine Tool Industry

In the machine tool industry, the hopeful forecasts for a general improvement are fully justified. A significant sign is the increased volume of inquiry for machine tools of the heavier types, and this is especially noticeable in turret lathes, drilling machines, and milling machines. Another prominent feature is the continued interest in sheet-metal working tools and presses of all classes. Grinding machine makers, in general, are very well employed, and practically every type of grinding machine is represented in current order books. In particular, the segmental wheel type of surface grinder is being adopted for a wide variety of operations that previously called for planing or milling, and firms making segmental wheel machines are working at full capacity.

Business in standard center-lathes is steady, and has shown little variation in the last three months. For the small and medium sizes of planers, the demand also is satisfactory. Power hammer makers are experiencing a quiet time, although there is no evidence that the power hammer will be easily ousted by more recent developments in forging presses. Within the last few months an interesting press with some of the characteristics of a hammer has been developed by one of the best known power hammer makers in Manchester. In this machine the rapidity of blow of a hammer is combined with the squeezing action of a press, the total effect being a series of rapidly reiterated squeezes.

Scottish machine tool makers have not had their due share of the increasing business in machine tools, but they have now got beyond the marking-time stage. Machine tool shops, however, are not yet working at more than one-quarter of capacity. As in every other center, the amount of inquiry from foreign markets is very encouraging.

Overseas Trade in Machine Tools

Following a spectacular jump in December, machine tool exports fell heavily in January, reaching a value of only £123,860 and a tonnage of 916, as compared with £147,760 and 1435 in December. Except for September, the tonnage was lower than any recorded during 1925. Imports in January maintained the figures for December, the value and tonnage in January being £67,260 and 467, respectively. The value per ton of exported and imported machine tools in January shows a sharp convergence from December's figures, the figures for January being £135 and £144 per ton for exports and imports, respectively. This value per ton for exports is abnormally high, but the upward move is too short-lived yet to draw conclusions from. The last six months, however, show a steadily increasing tonnage and value of imported machine tools. The first month of 1926 has fallen short of the average monthly value of exported machine tools in 1925 in the ratio of 106 to 120, where 100 represents the average pre-war value of exports.

An analysis of the exports of machine tools in December last shows that India was England's best customer, and bought tools to the value of about £48,000, Australia following with £30,000. Russia, with £12,500, and France, with £9000, were also good customers. China bought lathes to the value of nearly £4000. America sent us machine tools to the value of £37,000 in December, while Germany's contribution was worth over £20,000.

The General Engineering Field

In the general engineering field, the reports of improving business are backed up by a steady fall in the number of unemployed in practically every large manufacturing area. Heavy electrical engineering shows continued activity, and some recent orders in connection with new power stations in Leningrad and Central Russia are among the most important ever received by British firms. Norway, Greece, Denmark, and Spain are also contracting for a good deal of power plant equipment from this country, but the market in other Continental countries in this line continues to be poor.

Locomotive builders have received some valuable additions to the work they have in hand, and most of them will be kept busy for nine to twelve months of this year at least. Rolling stock makers also are well occupied with orders for home and overseas railways.

Textile machinery makers are working short hours, although one or two well-known firms experienced a considerable improvement during the last four months of last year, and in their cases the improvement is maintained. For looms, all the world's markets, with the exception of America, Russia, and Japan are well represented among orders in hand. Engineering firms supplying the varied requirements of the building trades, collieries, and sheet-metal trades are in a much better position than those dealing with the textile and allied industries.

While constructional engineers can look forward to the remainder of 1926 with a fair amount of equanimity, firms specializing in large conveyors have not much cause for optimism. Such inquiries for conveyors as are sent out are widely broadcast, and competition is international in character and exceedingly keen.

Transmission engineers are quiet, and the bulk of their orders are from the home market. Boiler makers also are working far below capacity. Home inquiries for gas and oil engines are improving, and India, Egypt, and Rumania are noted among the best overseas customers at the present time.

Shipbuilding Improving

Although the long-lived depression in the shipbuilding yards cannot be dispersed in a moment, there is much evidence that the Clyde, at least, shows signs of improvement. Orders placed for new vessels during the last few weeks amount to a substantial tonnage, and providing the development of labor troubles can be avoided, there is every prospect of an increase of work in the yards. Several of the new orders have undoubtedly materialized as a result of the guarantees under the Trade Facilities Act. Many motor vessels figure among new orders. The Tyne also shows some new orders for vessels, and a decrease in the unemployment registers. Barrow is also participating to some extent in the improvement in shipbuilding, and on the Mersey, some extensive repair and fitting work is in hand.

The Automobile Industry

The automobile, motorcycle, and bicycle industries continue to expand, and rapid progress is being made with works extensions. A rapid growth has been noted recently in the demand for engine units for export, and there is an increasing demand in Germany for British automobile parts ready for assembly, although Germany buys few complete British cars.

Current Editorial Comment

in the Machine-building and Kindred Industries

INSURANCE ON MACHINERY PLANTS

In commenting on the destruction of a machine tool plant by fire some weeks ago, a manufacturer remarked that too many machinery builders consider they carry sufficient fire insurance if it covers the cost of the buildings and their contents; but one of the greatest losses to a machinery builder is the loss of business while a new plant is being erected and put in operation, and the possible loss of customers who may turn to competitors in the interval, and sometimes are lost permanently. Therefore, "use and occupancy" insurance is a very necessary kind for every machine builder and equipment manufacturer.

The machine tool industry differs from others in another respect. If a machine tool plant burns, the equipment necessary for providing repair parts and tools for the machines built in the past are usually destroyed, and the customer loses time and money because such parts and tools can only with difficulty be procured from some other source; the delay may be much more costly than the actual repair parts.

Recently a representative of one of our large machinery manufacturing plants visited a machine tool shop from which a large amount of equipment had been bought, for the purpose of examining the fire hazard and determining the effect on the customer's own plant of a fire in the machine tool plant which would prevent obtaining accessories and repairs promptly. As a result of this visit, the machine tool manufacturer erected a large fireproof vault in which is carried an emergency supply of repair parts and accessories for his customers.

It has been suggested that every machine tool plant should be equipped with sprinkler systems, and that all machine-building plants of every type should carry sufficient insurance to replace every kind of fire loss. The cost of such insurance may be fairly included in the price of the machines built, because it is actually an insurance for the protection of the machine tool builder's customer, and is a small percentage of the yearly sales.

* * *

THE EVOLUTION OF MECHANICAL ADVERTISING

Few of the younger men in the machinery industry realize that our methods of advertising machine tools and accessories have changed more completely than have our designs and shop methods in the last thirty years.

No one then thought of including detailed technical and engineering information in his advertising. Instead of the full pages and "spreads," in which advertisers now show by photograph and detail the actual performance of machines and tools, thirty years ago they were satisfied with a small wood cut of the tool, with a line or two giving the name and address of the firm. No one thought of illustrating machines in action and calling attention to performance records.

Such expressions as "Built of first-class material"; "First-class workmanship in every particular"; "Well adapted to the uses for which they are constructed" were found on every page. Modern mechanical advertising is as different from that of thirty years ago as the machines of 1925 are from those of 1895.

It is interesting also to note the great development that has taken place in the machine tool, small tool and shop accessories industries, simultaneously with the development in advertising methods. Thirty years ago these industries had but few foreign representatives; today the sale of such American products is worldwide. What part advertising has had in the increased sales cannot be estimated accurately; but one has kept pace with the other.

* * *

TECHNICAL WRITING PAYS

A letter from a regular contributor to MACHINERY emphasizes the benefits that the writer himself derives from recording his experiences in a technical journal.

"I certainly am receiving marked personal benefit," he writes, "both in an educational and a financial way. I learn more about my own work and become more proficient in it each time that I sit down to place before your readers, in a clear and concise form, such ideas or descriptions of mechanical devices as have proved of value in the shops and drafting-rooms where I have worked."

Our contributor has discovered the principal value of technical writing to the author himself. The money received for the articles constitutes a minor part of the author's compensation. A far greater value is derived from the research necessary to gather information for the article—mental work which would not have been done otherwise. Many a man thinks that he "knows it all," until he sits down to convey to someone else, in writing, the information in his mind. Then he discovers the gaps in his knowledge; and most writers know far more about their subject when they have finished an article than when they began. This is one of the rewards of writing for the technical press, and one reason why contributors to mechanical journals usually continue unless they attain positions where it is impossible for them to spare the time.

* * *

THE DESIGNER AND TOOL ENGINEER SHOULD COOPERATE

About twenty-five years ago, the designers of machinery and mechanisms considered themselves quite superior to the tool designers who merely provided the drawings for the jigs and fixtures used in building the machine. The machine designer stated what he wanted, the tool designer was supposed to find ways and means to make it; and that was all.

But we have since learned that the sale of a machine depends not only upon a good design, but also upon the price for which it can be sold. The tool engineer—as he is now called—is as important a man as the machine designer, and to insure the best results, the two must cooperate closely. The tool engineer suggests to the designer changes which will facilitate and cheapen the production of the machine; and if the designer finds that the proposed changes do not reduce its efficiency, he should make them. The engineer who will not consider suggestions because they appear to reflect on his work, has no place in the modern plant. The more readily he accepts, and the more impartially he investigates the practicability of the suggestions made by others, the more valuable he is to the organization, and the better he serves his own future, as well.

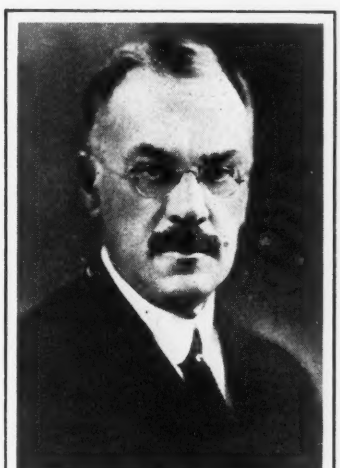
When you consider that a saving of only twenty cents in the manufacture of each Ford car amounts to $400,000 a year, it is evident that cost saving is an important consideration in the design of any machine or mechanism which is to be produced in considerable quantities. In the automotive industries, this cooperation between the designer and the tool engineer has been carried further than in any other field, resulting in reduced costs combined with quality in successful automobiles.

Promoting Friendly Relations in Industry

By E. M. HERR, President, Westinghouse Electric & Mfg. Co., East Pittsburg, Pa.

ABOUT ten years ago, progressive managers of industrial undertakings began to make an effort to get into closer contact with their employes, and to this end, encouraged the formation of committees of workmen in each manufacturing plant who could meet jointly with the foremen and other executives and discuss matters of mutual interest. Through these meetings, each side obtained a broader and more correct view of the other's problems and conditions, and were able to reach agreements promoting harmony and cooperation that would otherwise have been impossible.

Such committees or work's councils have now been formed in a great many industries, and it is reported that the number in operation increased from about 200 in 1919 to over 1800 in 1924, affecting a million and a quarter workers, or about one-tenth of those employed in the manufacturing industries. These committees are elected by ballot by the workmen in such a way as to make them representative bodies; that is, each elected member of a "joint conference committee," as they are frequently called, represents a group or certain number of employes. The members are elected at regular intervals, usually annually, so that they are at all times the real choice of the employes they represent. The group of employes elected by the workmen joins a group of employes appointed by the responsible officials of the company, usually composed of foremen, assistant foremen, chief clerks, store-keepers, and other minor officials, with whom the representatives of the workmen have contact in their daily duties and with whom they are more or less acquainted. The representatives of the management sit in conference with the representatives elected by the workmen, and the two groups form the joint conference committee.



E. M. Herr*

The Method as Worked out at the Westinghouse Plant

Referring more particularly to the joint conference committee of the Westinghouse Electric & Mfg. Co., which is fairly representative of similar organizations in other companies, this committee is called together at regular intervals of one or two months by the works manager, who generally presides at the meetings. In order to avoid any feeling among the members that the proceedings of the committee are not correctly or fairly expressed in the minutes, two secretaries are appointed—one elected by the representatives of the men, and the other by the appointees of the management. These two secretaries, both of whom are stenographers, carefully compare their notes of the proceedings of each meeting, and no permanent record is made until it is signed jointly by both secretaries. The entire minutes of each meeting are then published in the next issue of *Shop News*, a paper in which are recorded the local happenings among the employes, as well as interesting items regarding the activities of the company. *Shop News* is edited and printed by the company's publication department, and the entire expense is borne by the company. It is distributed without charge to the employes.

The Distinction between Owners and Management in Modern Industrial Undertakings

Does this joint conference committee fairly replace the former personal contact between the responsible head of the business and the employes working under his direction? Before attempting to answer this question, it should be understood that a modern manufacturing industry is no longer owned in a large measure by those responsible for its management, as was the case a generation or two ago. The ownership of a modern industry is now spread among many thousands of stockholders—in the case of two of the largest corporations, the number of stockholders has increased in the last twenty years from less than 10,000 to over 300,000.

It is becoming increasingly true, therefore, that in the case of our most important industries, no large amount of stock is in the hands of any one individual or even any cohesive group of individuals. As a result, the officers are not controlled by any dominating owner or group of owners, and there is no one man or small group owning or representing a controlling interest in the company with whom the officers can confer in order to be guided as to its policies. This condition places a heavy responsibility upon the board of directors and the principal officers of such companies. From a legal standpoint, this responsibility is to the stockholders only, but it must not be viewed too narrowly if one is to measure it correctly.

The Responsibilities of the Management of an Industrial Enterprise

In order to be properly safeguarded, the interests of the stockholders, the interests of the customers (the consuming public), and the interests of the employes must all have the fullest consideration; in fact, the first consideration must be the interest of the customer, for, unless he is satisfied and attracted by the treatment he receives, business is lost and the company languishes, unemployment for the worker being one of the results.

Second in importance in the management of the business, for the best results to the stockholders, is the older—the trained—employe, who can only be replaced by one with a background of a generation of similar training and education.

Third in importance must be placed the capital contributed by the stockholders, which, although first in the order in which the company is built up, is the most easily replaced when impaired; and furthermore, by weighing the interests in the order stated, the stockholder is really given the best and truest consideration for the safeguarding and building up of his interest.

The interests and requirements of the customers are so evidently the concern of all employes, and the effect of ne-

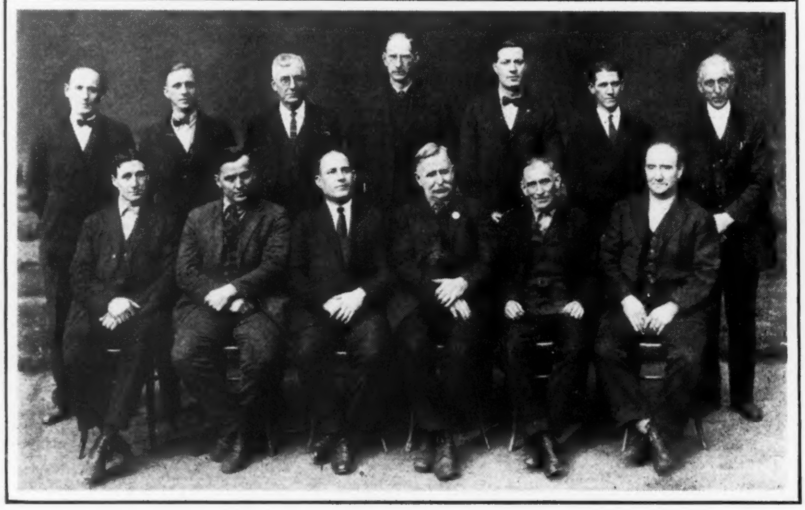
*E. M. HERR was born in Lancaster, Pa., May 3, 1860. When he was twelve years old his family moved to Denver, Col., where at the age of sixteen, he went to work as a telegraph operator. Later he began to learn the railroad business as an employe of the Kansas Pacific Railroad, now a branch of the Union Pacific. Realizing the need of a more thorough education than he had had up to that time, he gave up his job to enter the Sheffield Scientific School of Yale University. At the age of twenty-four he graduated, having worked his way through college by tutoring other students. His summer vacations were spent in the Altoona Shops of the Pennsylvania Railroad, and after graduating from Yale, he entered the shops of the Chicago, Milwaukee & St. Paul Railroad as an apprentice, later working in the mechanical engineer's office of the Chicago, Burlington & Quincy Railroad as draftsman. Here he soon became assistant engineer of tests. At the age of twenty-seven he was appointed superintendent of telegraphs of this railroad, and later made superintendent of the St. Louis Division. Then he took charge of the Milwaukee Shops of the Chicago, Milwaukee & St. Paul Railroad, being, at the age of thirty, head of the shops where he had served his apprenticeship. After a period with the Chicago & Northwestern Railroad and later with the Northern Pacific, as superintendent of motive power, George Westinghouse, in 1898, induced him to leave railroading and to come with the Westinghouse Co. as assistant general manager. In 1911 he was made president of the Westinghouse Electric & Mfg. Co.

glect in this regard is so quickly noticed, that there is little difficulty in correcting deficiencies in this part of an industry's operation.

The Most Intricate Problem of Management—The Management of Men

The maintenance of proper relations between employer and employe, comprising as it does the training, handling, and disciplining of all employes in such a manner as to keep them satisfied and to bring about the most effective production relationship to industry is a much more intricate problem, and, as previously stated, is the most important and difficult one with which those in charge of a company are confronted today.

It is too soon to speak with confidence of the part played by the joint conference committee in solving this problem, and like many other problems, whether it is a pronounced success or a total failure will depend upon the manner in which it is handled. Enough evidence is at hand to show that a great deal of value, both to the employer and the employe, has come from the establishment of a relationship cooperative in its character and educational to both parties. This relationship having been established, labor can play a large and important part, of tremendous value to itself and the consuming public—of which it forms so large a part—if it will adopt a broader attitude than it has heretofore assumed and concern itself not only with those things that will further its own narrow interest, but also, and principally, with those that are of the most benefit to all connected with the industry.



The Executive Committee of the Joint Conference Committee of the Westinghouse Electric & Mfg. Co.

I have stressed the importance of cooperation between employer and employe. In certain directions there is no limit at which such cooperative effort should stop; in others, however, there is a limit beyond which it is not only unwise to go, but positively injurious, alike to employer and employe, and consequently to the public which both must serve. There is much loose talk among men of high standing, but generally with very limited experience in industry, about the democratizing of industry and giving the men a share in the management of industrial properties. To the extent of a cooperative effort between employer and employe to improve working conditions, or to better any situations that are unsatisfactory to the employes, such as wages and hours of service, well and good; but I maintain that the limit has been passed when enthusiastic reformers advocate giving a voice in the financial and business management to the workman, who is not responsible for bringing the industry into existence and has no responsibility for the operating results.

While many managers have come from the ranks and there is no limit to the possibilities of advancement for the workman, a responsible management is needed to provide for the development and even existence of the industry.

* * *

The property lost in the United States by fire amounts to approximately $500,000,000 annually—a sum of money that would build a Panama Canal every year and yet leave $150,000,000 to spare, sufficient to change the Canal from a lock canal to a sea level waterway. Using the approximation of five people to a family, the annual fire loss in the United States is about $25 per family.

HEAT-TREATING IN THE NASH PLANT

Electric furnaces are now used in the Milwaukee plant of the Nash Motors Co., for all heat-treatment of metal parts, with the exception of cyanide hardening. Carburizing and annealing operations are performed in eight box type furnaces, six of which were installed by the George J. Hagan Co., Pittsburg, Pa., and two by the Hevi Duty Electric Co., Milwaukee, Wis. The Hagan furnaces are about 42 inches wide and 76 1/2 inches deep inside, and have a door opening 24 1/2 inches high, while the Hevi Duty furnaces are 40 inches wide and 76 1/2 inches deep inside, and have a door opening height of 24 1/2 inches. An Elwell-Parker electric truck equipped with long forks which can be elevated and lowered, is used to place the work into the furnace and to remove it. One man tends the eight box furnaces.

There are also two large Hagan furnaces of the rotary type. The larger has a 3-foot hearth, about 10 feet 5 inches outside diameter, which rotates the work around the heating elements. This furnace is used for hardening and tempering camshafts, axles, and other comparatively large pieces. The smaller furnace has a 2-foot hearth, 8 feet 3 inches outside diameter, and this hearth also revolves, carrying the work around the heating elements. Small pieces such as connecting-rod bolts, sliding gears, transmission-gear shift rails, and rocker arms are handled in this equipment.

Both rotary furnaces are equipped with two doors; the work is placed on the rotary hearth through one of these, and removed through the other after it has made a complete circuit of the furnace. Either hearth can be made to revolve once every 45 to 60 minutes to suit requirements. One man loads and unloads each of the rotary furnaces.

Immediately in front of each rotary furnace there is a series of three quenching tanks. One of these contains brine, the second clear water, and the third motor or automobile oil. The brine is kept in circulation, and the clear water and oil are maintained at a temperature of between 90 and 100 degrees F. by the use of water coils.

All the furnaces are controlled by Leeds & Northrup temperature recorder potentiometers which are installed in a separate room. An attendant in this control room notifies the man in charge of the box furnaces when each batch of work has been in a given furnace the required length of time. There are push-button controls on each furnace for shutting off the heat.

In this heat-treating department, about 30 tons of parts are handled per 24-hour day, and the temperature of the department, even on hot summer days, is not more than 20 degrees higher than outside. Many gears are heat-treated right in the production line in the gear-cutting department by means of Leeds & Northrup electric furnaces, seven of these furnaces being installed in the department.

* * *

The American Management Association is planning a tour of England, Belgium, Germany, Italy, Switzerland, and France this summer. The itinerary includes visits to a number of leading concerns in England and on the Continent. Those interested in participating in this tour should communicate with the managing director, W. J. Donald, American Management Association, 20 Vesey St., New York City.

Gear-Tooth Grinder and Tester

National-Cleveland Equipment for Producing and Testing Gear Teeth Accurately as to Contour and Spacing

PROGRESS in methods of gear manufacture during recent years has brought about the development of grinding machines for producing involute teeth of great accuracy. Gears with accurately ground teeth possess the advantage of close approximation to the theoretically perfect rolling action of correct involute teeth. The greater smoothness of ground tooth surfaces eliminates noise and vibration and adds to their durability. A recent addition to this class of machines is the "National-Cleveland" gear tooth grinder developed by the National Tool Co., Cleveland, Ohio.

This machine operates on the generating principle, the gear to be ground being given an oscillatory rolling movement in contact with the face of the grinding wheel. Oscillation of the work-spindle head is accomplished by a cam of involute form, which not only furnishes the required movement, but also assures smoothness of action without shock or vibration. The machine is designed to meet the conditions of modern plants engaged in mass production, and requires only semi-skilled labor for its operation, after it has once been set up for a given job.

Power for driving the machine is provided by two 3/4-horsepower motors which are mounted within the base of the machine, wire-mesh doors being provided in the base to afford the necessary ventilation. The motors are furnished with push-button controls. One motor performs the single operation of driving the grinding wheel spindle, through a 3-inch woven fabric belt which runs up through the column of the machine where it is completely enclosed. This wheel-driving motor is mounted on a hinged base on which screw adjustments are provided, which serve as a convenient means for regulating the tension of the belt.

The second motor furnishes power for all other movements. Two separate functions are required; namely, the rolling of the work into and out of engagement with the grinding wheel, and the indexing of the work after each individual cycle of the rolling generating action has been completed. For the rolling generating action, power is delivered from the motor to a longitudinal shaft on which a worm is mounted. This worm meshes with a wheel mounted on a cross-shaft that carries crank disk *C*, Fig. 3, on its opposite end. Bar *D* which is operated by this crank, has rack teeth cut in one end, which mesh with segment gear *E*, this gear being carried in a frame that also contains bearings through which rack bar *D* has an oscillatory sliding movement. The oscillating movement afforded in this way is transmitted by a cross-shaft to the opposite side of the machine, and thence, through a link mechanism *H*, Fig. 4, to the work-spindle. The work-spindle is composed of two members—the spindle proper and an outer sleeve which is free to oscillate around the spindle. The gear to be ground is seen at *I*.

The entire work-spindle unit is carried by a head that is mounted on a slide. On the spindle sleeve and enclosed by case *J* is the involute cam which provides the necessary longitudinal oscillating movement of the slide for rolling the gear to be ground in contact with the face of the grinding wheel. This arrangement of the cam will be better understood by reference to the detail view, Fig. 5. Here it will be seen that the cam is mounted on the work-spindle sleeve at *K* and runs in contact with a roller *L* secured to a fixed member *M*. The cam is kept in contact with the roller by means of a counterweight housed in the base of

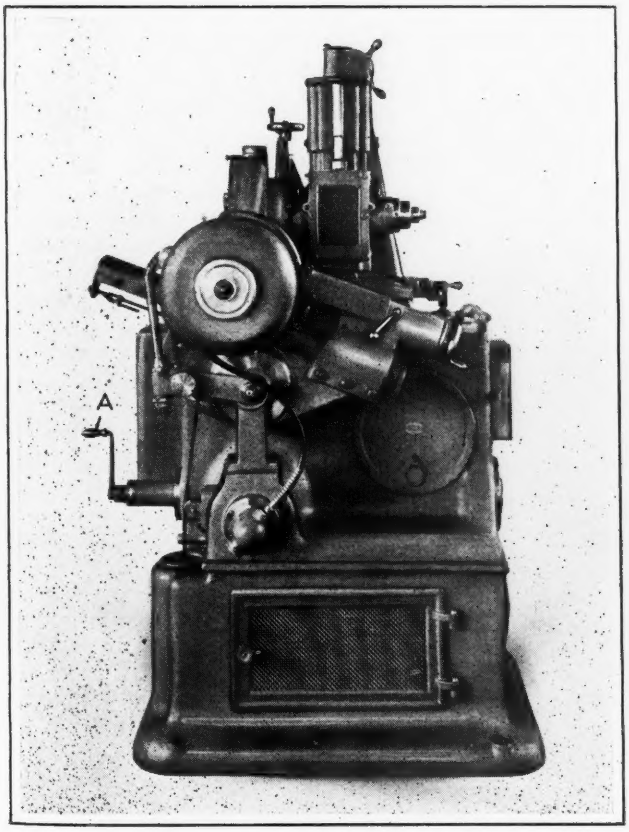


Fig. 1. National-Cleveland Gear-tooth Grinding Machine

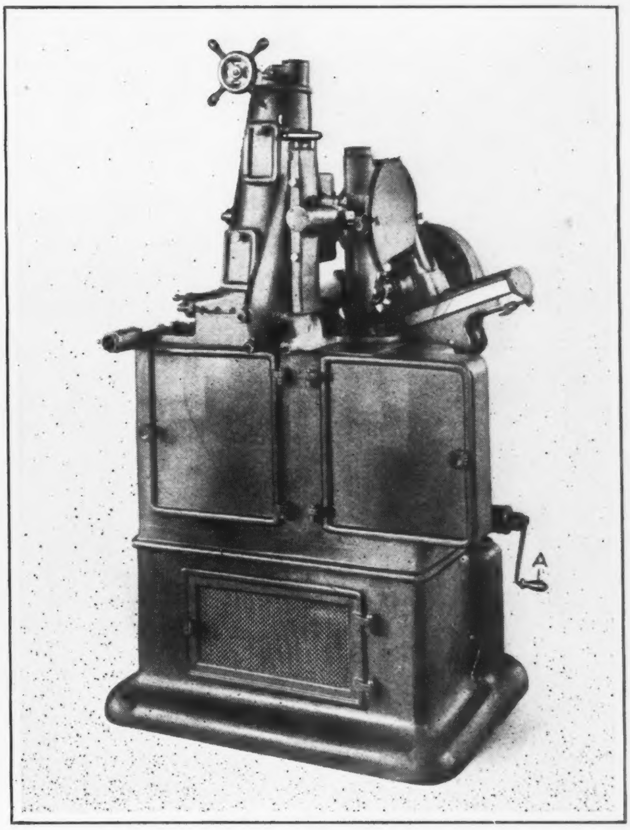


Fig. 2. Another View of the Gear-tooth Grinder shown in Fig. 1

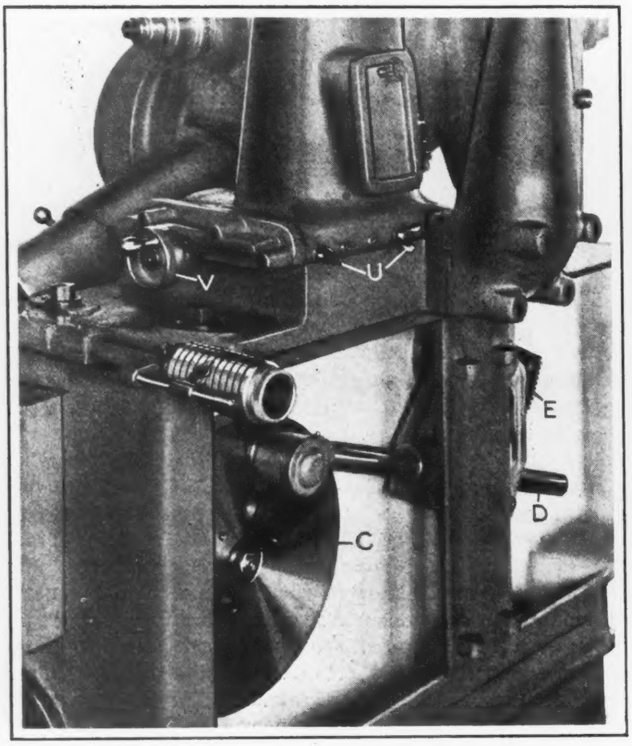


Fig. 3. Mechanism that produces the Rotary Movement of the Work-spindle

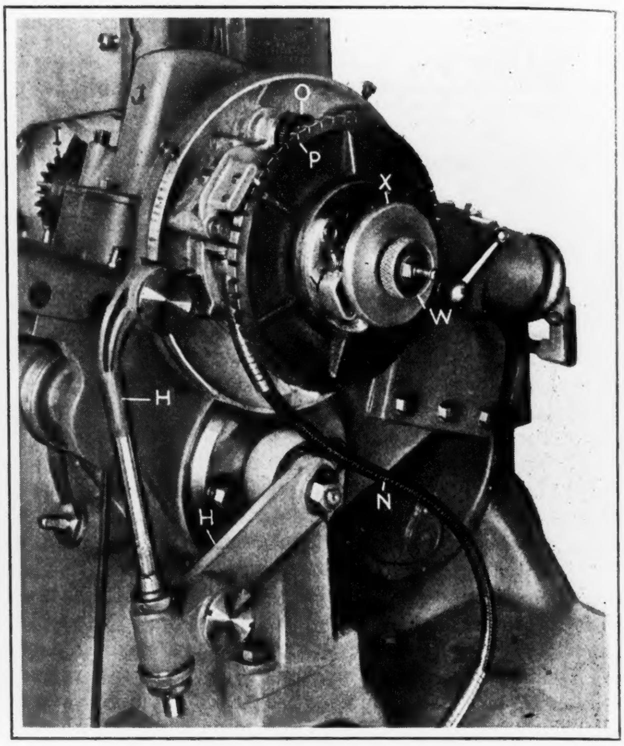


Fig. 4. View showing Notched Wheel and Pawl used to lock Work-spindle after indexing

the machine. As a result, the oscillating rotary movement imparted to the work-spindle also produces a longitudinal movement of the slide that carries this spindle. Thus, the work is rolled into and out of contact with the grinding wheel in just the same way as the required form of gear would roll in contact with a rack of corresponding pitch. The use of the cam affords a dependable movement, free from lost motion, shock, or vibration.

The Indexing Mechanism

After the cycle mentioned in the preceding paragraph has been completed, it is necessary to index the work to bring the next tooth into position for grinding. This is accomplished in the following manner: Power for driving the indexing mechanism is taken from the main longitudinal shaft in the base of the machine and carried through a flexible shaft *N*, Fig. 4, to a worm and worm-wheel that operate a Geneva mechanism. This mechanism is so worked out that the indexing movements starts slowly, is accelerated through the first half of the movement, and then is decelerated toward the end. This variable movement overcomes inertia gradually and avoids shock. When the indexing movement has been completed, the Geneva mechanism is automatically locked to hold it positively fixed during the operation of grinding a given gear tooth. Then the mechanism is automatically released to provide for the next indexing movement.

From the Geneva movement power is transmitted through a set of change-gears which are partially shown at *O*, Fig. 4, and thence to a large gear carried on the work-spindle. By means of the change-gears, provision may be made for grinding work with any number of teeth.

After an indexing, the work-spindle must be positively locked against movement for the period during which the work is being rolled into and out of engagement with the grinding wheel. This is done by means of a pawl which enters successive notches in the anchor wheel *P*. It is impossible to avoid a slight amount of wear between the pawl and the notches in the anchor wheel, after a long period of service, but by substituting a pawl of a slightly different width, the point of engagement between the pawl and the notches in the anchor wheel is changed, and the original high degree of accuracy of the anchor wheel is restored. It is to be understood that this wear between the pawl and the notches in the anchor wheel is extremely small, and is to be expected only after the machine has been in service for a long while. The end of the pawl is rounded.

A cam geared to the index mechanism lifts the pawl be-

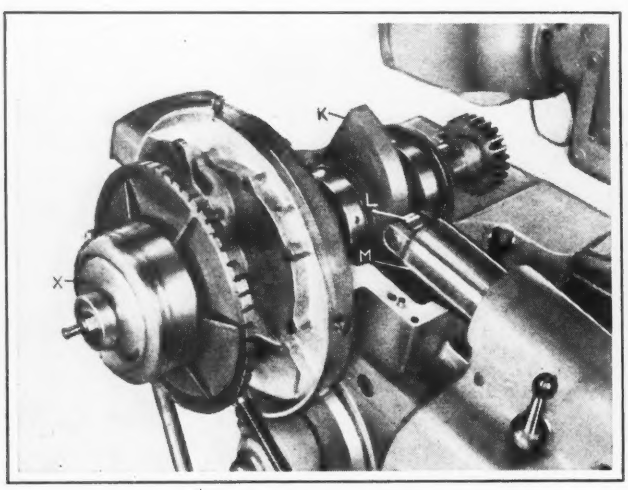


Fig. 5. Involute Cam Arrangement employed to actuate the Work-spindle Head

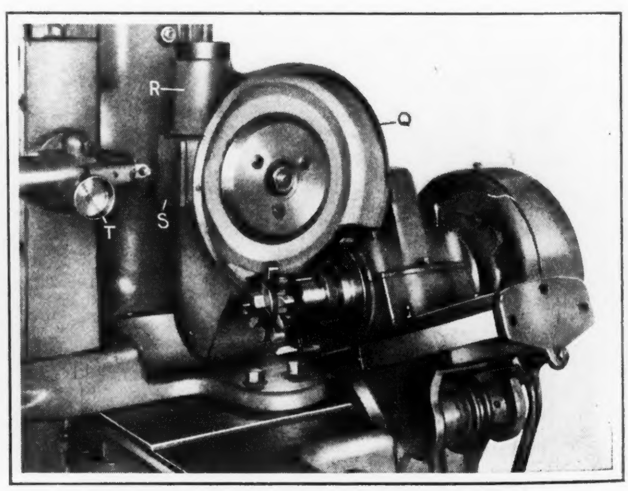


Fig. 6. Close-up View of the Work, Grinding Wheel, and Truing Diamond

fore an indexing starts. When the indexing movement has been completed, the anchor wheel, carried by the spindle, has turned sufficiently to bring the next notch into place to receive the pawl. The notches in the index-wheel are tapered so that accuracy in indexing is assured by the index-wheel being moved through the slight amount necessary to allow the pawl to seat itself in the notch of the wheel. This mechanism positively anchors the spindle in place during the grinding period of the cycle.

Provision is made for truing the grinding wheel as it becomes dull. Referring to Fig. 6, it will be seen that the grinding wheel is enclosed in a housing *Q* which is furnished with a connection *R* leading to the exhaust system. At the back of housing *Q* there is a small door *S* that can be opened to allow the diamond tool to be brought into contact with the wheel. This tool is carried by a bar having a rack and pinion mechanism for imparting the required oscillatory movement produced by turning the knurled thumbwheel *T*. Obviously, a dressing of the grinding wheel requires that the wheel be moved forward toward the diamond. This is accomplished by loosening clamps *U*, Fig. 3, that hold the wheel-slide in place and then advancing this slide by turning handwheel *V*.

To remove stock from the work, it is necessary to provide means for feeding the work up to the wheel. The provision for this purpose is best shown in Figs. 4 and 5, where a thumbwheel *W* may be seen. By turning this thumbwheel the work-spindle is rotated to advance the work to the grinding wheel, the amount being indicated by progressive positions of a spring plunger that enters pockets in a fixed disk.

Turning thumbwheel *W* rotates a crown gear *X*, which meshes with a small spiral gear *Y*. Mounted on the same shaft as this spiral gear there is a worm which meshes with a worm-wheel secured to the work-spindle. In this way the movement is transmitted to the spindle, which is held against further movement by means of the spring plunger to which reference has been made.

It will be apparent that in a machine designed for the accurate work done in this gear-tooth grinder, freedom from vibration and lost motion are essential points. In working out the details of the design, all shafts have been liberally proportioned to guard against "lag" resulting from torsional strains. At the same time, it is necessary to have a machine as free as possible from frictional losses, so that it is sensitive in operation. This factor is important in order that the different movements may be automatically performed and synchronized, without lost motion or shock. The machine is equipped throughout (except the grinding wheel spindle) with ball bearings. These ball bearings may be packed in enough grease to give efficient lubrication for several months.

In conformity with accepted practice in the design of precision machine tools, the grinding wheel spindle is mounted in adjustable bronze bearings, as it was not found possible to employ anti-friction bearings and still secure the freedom from lost motion and vibration that is necessary for this class of work. The machine can be easily run through all of its movements by turning the hand-crank *A*, Figs. 1 and 2.

In cases where a high degree of precision is required, as in master gears, it is said to be feasible to hold the spacing of the teeth within plus or minus 0.0001 inch, and to so finish the gear-tooth contours that they do not deviate more than 0.00005 inch from the outline of the required involute curve.

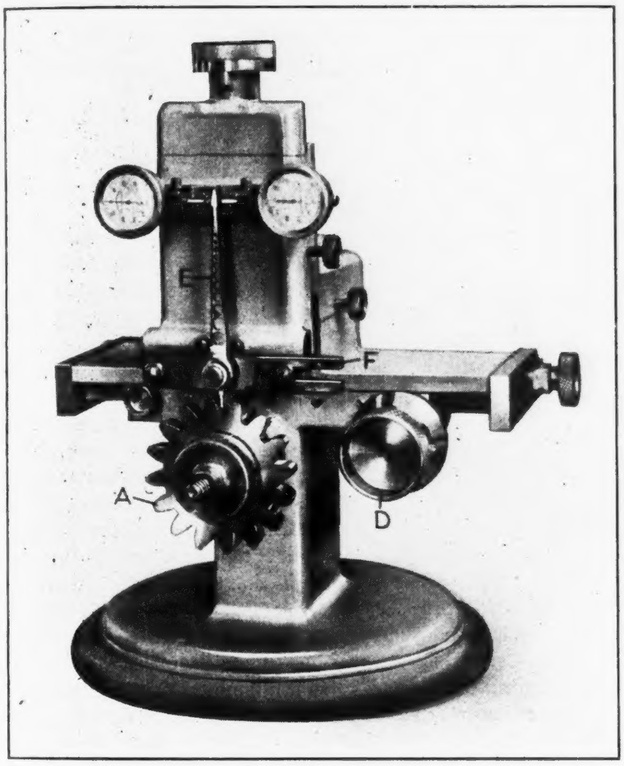


Fig. 7. Testing Machine used for determining Accuracy of Ground Teeth as regards Tooth Form and Spacing

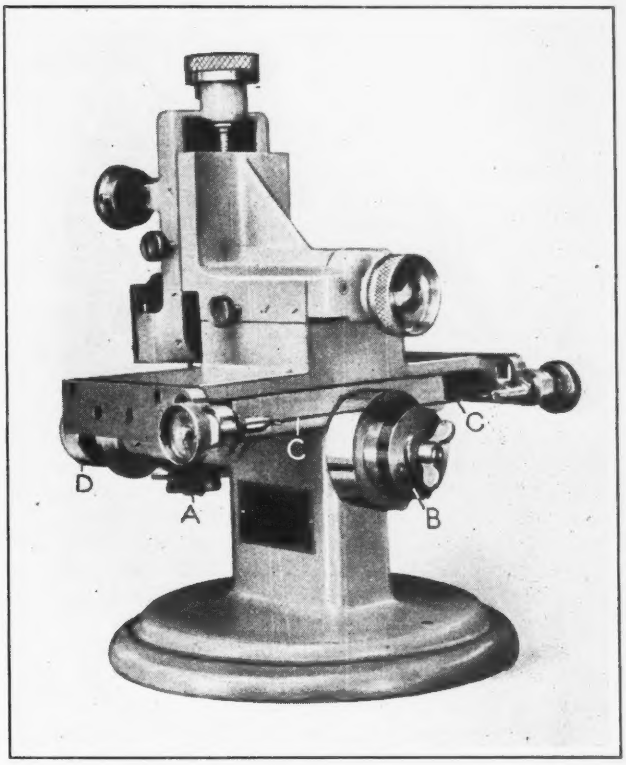


Fig. 8. Rear View of Testing Machine, showing the Arrangement of the "Base-circle" Disk and Tapes

The Gear-tooth Testing Machine

Obviously, it is important to have some means of determining the exact degree of accuracy in both the tooth form and spacing of teeth ground on the machine. For this purpose, the National Tool Co. has also developed the tester illustrated in Figs. 7, 8, and 9. A spindle running transversely through this machine is provided at the front end with means for mounting the work *A*. At the rear of this spindle is mounted a disk *B* of the same diameter as the base circle of the gear to be tested. Steel tapes *C* are wrapped around this disk and secured to opposite ends of the machine. When the slide carrying the indicators is moved transversely, these tapes cause the spindle to rotate. This imparts a rolling action to the gear and also causes the contact needle point of the dial indicator amplifying lever arm *E* to move along a line tangent to and uniform with the base circle. Any divergence from the true involute form of the tooth contour will be shown by a deflection of the indicator needle. The two indicators provide for testing opposite sides of gear teeth.

Attention is called to the fact that the contact point of the dial indicator amplifying arm must be located at a distance from the center of rotation of the gear equal to the radius of the base circle. Master disks are employed for accomplishing this. The contact point is hardened and honed to an inverted cone, as shown in Fig. 10, the sharp edge maintaining a point contact with the work. It is possible to check the accuracy of the readings secured with this gear-testing machine by reversing the gear on the arbor and taking the same set of readings with the other dial indicator. If the two sets of readings correspond, it shows that the machine is accurate.

The important feature of this testing machine is a provision that has been made for inspecting and charting the exact condition that is found at specified intervals along the contour of both sides of each tooth in a gear-shaper cutter or in a master gear. In such cases, absolute knowledge concerning the form and spacing are of vital importance. Reference to Figs. 7 and 9 will show that there is a knurled thumb-nut *D* provided with a collar graduated into twenty spaces. The procedure is to chart the condition found on both sides of each tooth on coordinate paper.

After the work has been set up on the machine, the inspector takes a horizontal line on his coordinate paper as the base line for one side of the first tooth tested. Vertical spacings along this line correspond to the spacings on the graduated collar, and the horizontal spacings on coordinate paper represent the degree of error found in units of 0.0001 inch. Starting with zero on the collar, the inspector notes the reading of the dial, and then turns to the next spacing and again notes the indicator reading. This is continued progressively until the collar has been turned sufficiently to traverse the indicator point over the entire contour of the gear tooth. For each reading, a point is located on the coordinate paper, after which a line is drawn through these points to give a graphic representation of the actual conditions for that side of the tooth. Absolute accuracy will be indicated by a horizontal line, while deviations will bring the line above or below the horizontal base line. A complete graph for a master gear or gear-shaper cutter can be laid out in this way, numbering the lines corresponding to the left and right sides of each tooth. A chart of this kind shows at a glance the actual conditions which exist.

For checking the accuracy of tooth spacing, it will be seen that there are two index stops *F* which can be set to engage opposite sides of the teeth of gears of various sizes.

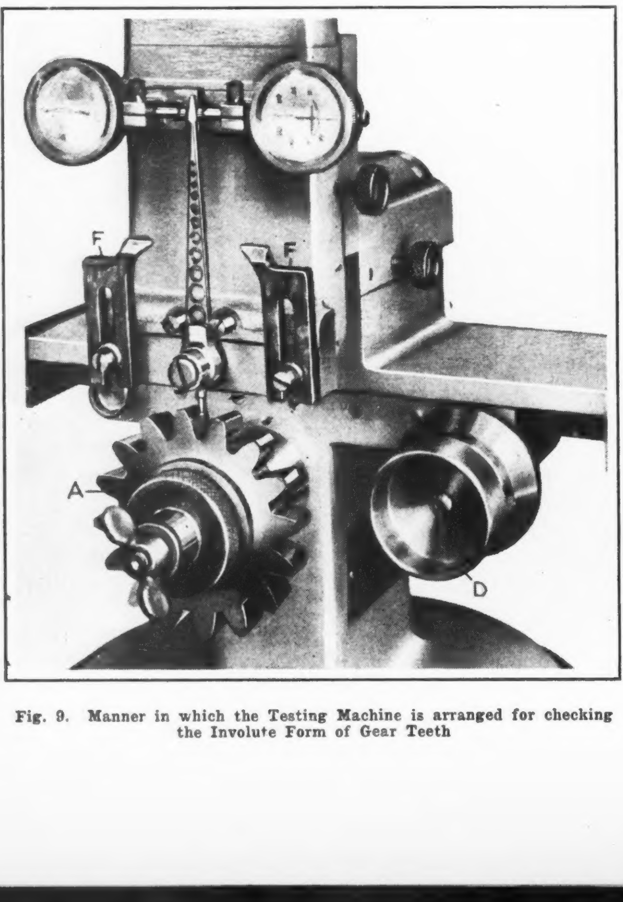


Fig. 9. Manner in which the Testing Machine is arranged for checking the Involute Form of Gear Teeth

In checking the spacing, the stop is set in contact with one side of one tooth, as shown in Fig. 7, and the indicator point is engaged with the corresponding side of the next tooth, after which the dial is turned to give a zero reading. The gear is turned by hand to locate successive pairs of teeth in contact with the index stop and indicator point as described. For perfect accuracy of spacing, the indicator will read zero for each setting, while any errors are shown by a deviation from zero.

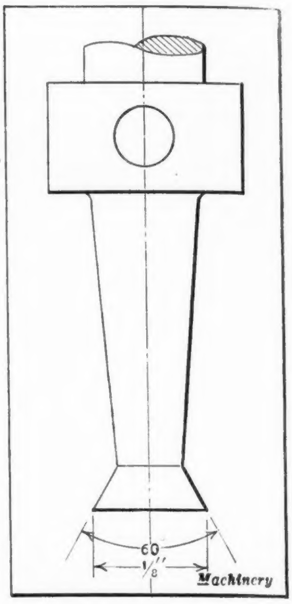


Fig. 10. Design of the Amplifying Arm Contact Point

* * *

CHICAGO MACHINE SHOP MEETING

On March 24, a machine shop meeting was held by the Chicago Section of the American Society of Mechanical Engineers in conjunction with the Mechanical Section of the Western Society of Engineers, in the rooms of the latter society in the Monadnock Building. Two sessions were held, one in the afternoon and one in the evening. At the afternoon session, three papers were presented. The first one dealt with tool manufacture versus tool making; its author was G. A. Pennock, technical superintendent of the Hawthorne Works of the Western Electric Co., and its title "The Division of Labor in Tool Making." Mr. Pennock dealt with the subject of dividing up the work between a number of men, each an expert on one particular type of work, as opposed to the old method of having one man follow the entire job through. In the second paper, "The Selection of Tool Steels," by J. B. Mudge, metallurgist with the Western Electric Co., reference was made to the methods of heat-treatment, microscopic studies, and other factors that have a bearing on the selection of steel. The third paper of the afternoon session dealt with "Maintenance and Upkeep," by George Hodge of the Industrial Relations Department of the International Harvester Co.

The opening paper of the evening session was prepared by Hugo Diemer of the LaSalle Extension University, who spoke on "Managerial Wastes in Machine Shops." In this paper reference was made to the statement, in the report of the Hoover Commission on Waste in Industry, that of the 28 per cent of preventable waste in the machine shop field, 80 per cent was due to factors over which the management has control. In his paper, Mr. Diemer pointed out where management is at fault. The topic of the last paper of the meeting was "Reclamation of Processed Material." Along this line the railways have perhaps done more than any other industries, and among the railways, the Santa Fé has been particularly active. Details on converting salvage material into a higher grade of product before disposing of it or reusing it for another purpose were given.

* * *

The American Society for Testing Materials has announced that Arthur N. Talbot, professor in charge of theoretical and applied mechanics of the University of Illinois, will be the first Edgar Marburg lecturer of the society, the first lecture to be delivered at the annual meeting in Atlantic City, June 21 to 25. Professor Talbot has for many years been actively engaged in studies of engineering materials, and has been associated with many investigations of a research nature, among them being an investigation carried out by a joint committee of the American Society of Civil Engineers and the American Railway Engineering Association. He was one of the first to advocate the need of extensive research work in connection with engineering materials as one of the activities of the American Society for Testing Materials.

FRICTION DRIVE FOR TAPPING MACHINE

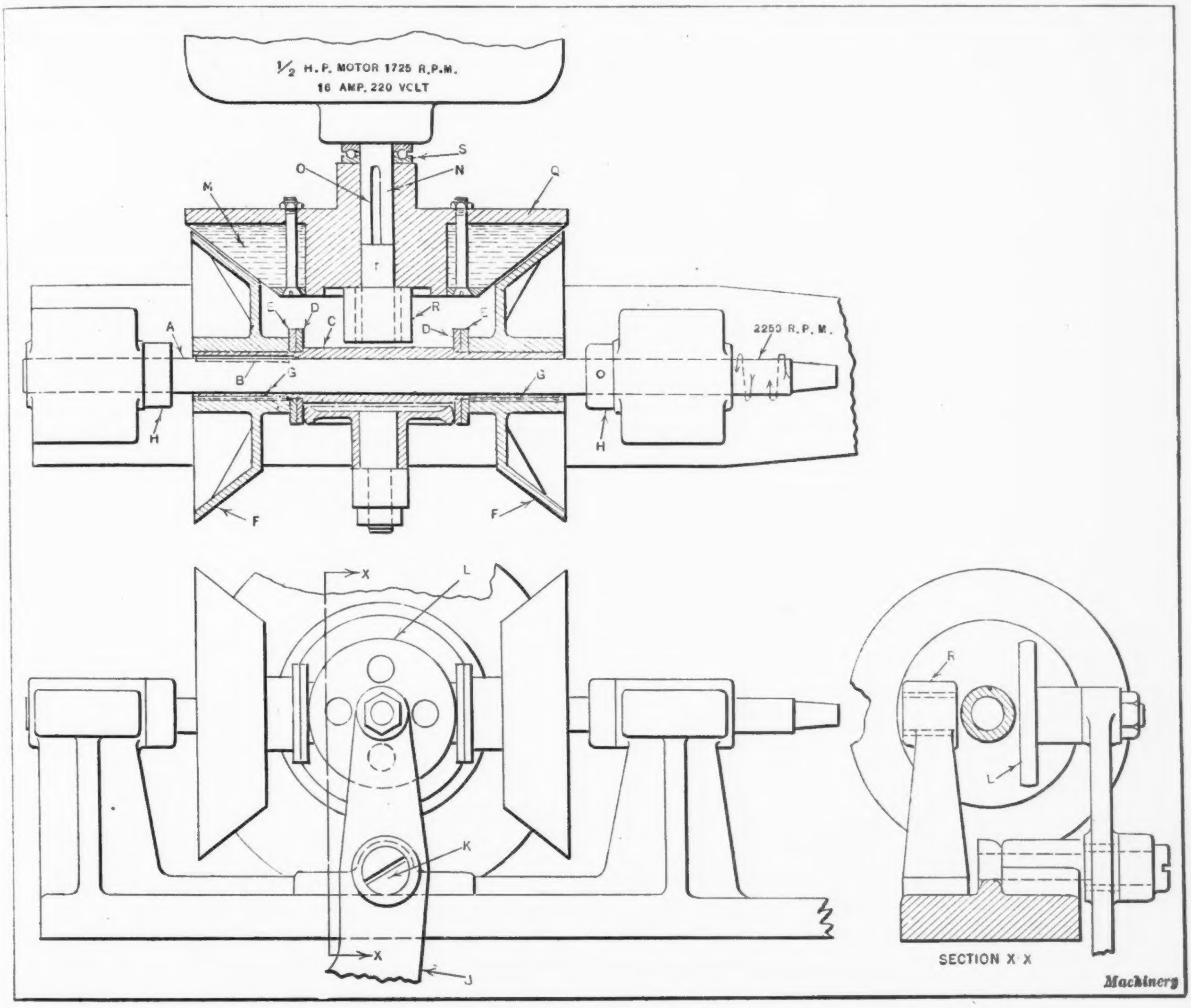
By J. E. FENNO

The writer was recently confronted with the problem of redesigning a standard straight- and crossed-belt drive for a tapping machine employed in tapping holes up to 1/4 inch in diameter. Approximately one hundred machines of this type were in operation, and it was believed that if the machines could be equipped with direct motor drive a large reduction in the overhead expense would be realized.

The spindle *A* of the old machine was used, a keyway being cut in it to receive the key *B*. The sleeve *C* was made from a piece of Shelby tubing, bored out to a sliding fit on the shaft *A*. A keyway was also cut in this sleeve, which was a sliding fit over the key *B*. The fiber washers *D* were forced on the turned down ends of sleeve *C*. The steel washers *E* and the aluminum cones *F* were next pressed or forced on the sleeve. Cones *F* are prevented from rotating on the sleeve by the keys *G*. The thrust imposed on the spindle by the tap is taken by the collars *H*, which are held in place by pins. The bearings for the spindle are an integral part of the machine frame, as indicated in the lower view.

The lever *J*, which is operated by a foot-treadle, pivots on the stud *K* and has at its upper end a brass roll or wheel *L*. When the upper end of lever *J* is moved to the right, the cone *F* at the left is drawn into contact with the cone driving member *M*, and the spindle *A* revolves in one direction. When the upper end of lever *J* is moved to the left, the drive is disengaged and the spindle comes to a stop. A further movement of the lever brings the cone *F* at the right-hand side of the driver *M* into contact with the friction surface of the latter member, which drives the spindle in the opposite direction.

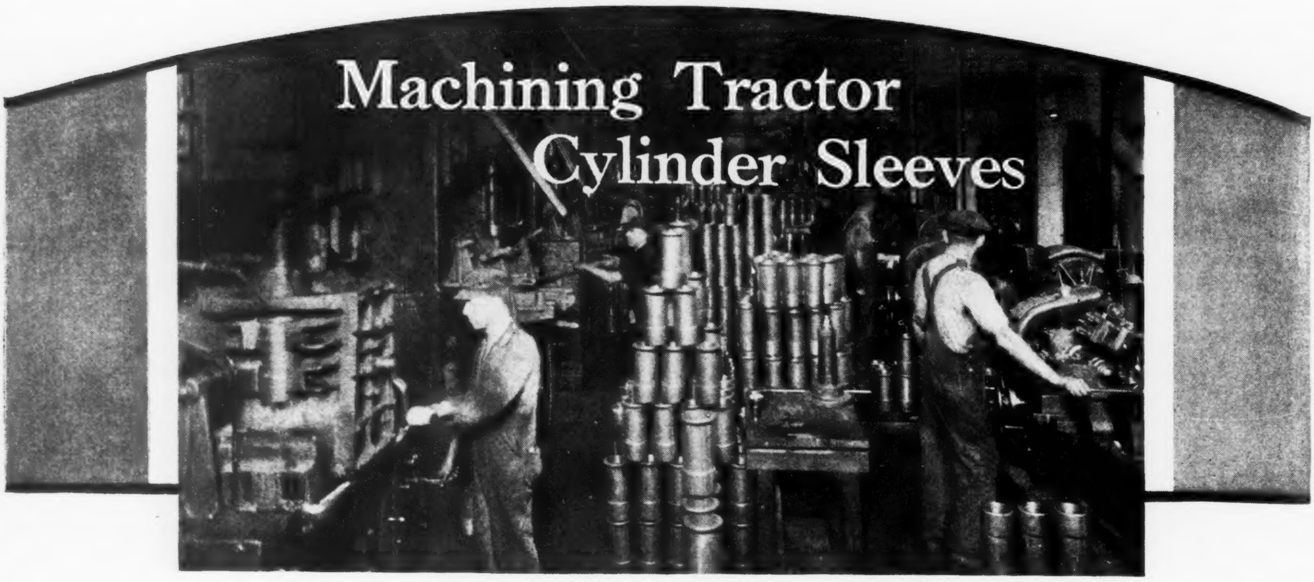
A 1/2-horsepower motor was employed to drive the tapping machine. The driver *M* was made a sliding fit on the motor shaft *N* and key *O*, to permit endwise movement of the motor armature. As the motor shaft end extended only a short distance beyond the bearing housing, a short piece of shafting *P* was driven into the casting *Q* and a supporting bearing *R* provided for its outer end. The friction driving member *M* is made up of leather disks bolted to the casting *Q*. It is necessary to exercise care in balancing the cone driving member in order to prevent vibration. The ball thrust bearing *S* receives the thrust on the driving member when the machine is in operation. The machines equipped with the drive here described have proved very satisfactory, quick reversal of the spindle with very little loss of speed being one of the desirable features provided by the direct motor drive.



Arrangement of Friction Drive on Motor-driven Tapping Machine

* * *

What is believed to be the first all-arc-welded gas holder built in this country was constructed during 1925 at Lexington, Mo., by the Western Gas Construction Co., of Fort Wayne, Ind. This holder has a capacity of 15,000 cubic feet of gas. Six weeks were required to build the holder. General Electric welding equipment was used, and two welders and three mechanics did the work. The bottom plates and the two upper courses of side plates are 3/16 inch thick, the first side course is 1/4 inch thick, and the container and crown are of No. 10 gage material. All seams are lap-welded. The bottom and side seams are 3/4-inch laps, the bottom seams being welded with a continuous fillet on one side, while the side seams have a continuous fillet on one side and tack welds on the other. The side seams of the container are welded on both sides with a continuous weld.



Operations Performed in Finishing Cylinder Sleeves for the Engines of the International Harvester Co.'s Tractors

ONE distinct difference between the typical automobile cylinder block and the cylinder unit of the agricultural and industrial tractors built by the International Harvester Co. is that the automobile cylinder block is a single casting, whereas the tractor cylinders are made up of a box casting and four separate ground sleeves in which the pistons reciprocate. Several advantages are obtained from this construction of the tractor cylinder. For instance, should a tractor be left in the open during freezing temperature and a cylinder bore become cracked, the sleeve could be easily replaced, whereas in the case of a block having the cylinders cast integral, it would be necessary to scrap the entire block. Similarly, if any of the sleeves become badly scored, they can be easily replaced.

Another important advantage of the tractor cylinders is that the sleeves can be machined uniformly on the internal and external surfaces, with the result that there is uniform expansion and contraction of the cylinder bores. Also, it has been easy to provide uniform water cooling space around the sleeves. It is a convenient matter to replace the sleeves, since they are assembled by hand—not driven into place. A water seal, consisting of a rubber ring, is provided at the lower end of the sleeves. The sleeves are iron castings, and cast-iron pistons are used in them. The production of these sleeves, as carried on at the Milwaukee plant of the International Harvester Co., includes a number of interesting operations which will be described in this article. A production ranging from 550 to 600 sleeves is attained at this plant per day, by two shifts of nine hours each.

Rough-boring, Turning and Facing the Sleeves

The first operation consists of boring hole *a*, Fig. 3, for the entire length to a diameter of 4.430 inches, removing about 3/16 inch of stock on the diameter. As illustrated in Fig. 1, the operation is performed on two sleeves simultaneously by the use of a two-spindle vertical machine. The sleeves are firmly supported in a heavy jig, which is provided with two sets of jaws *A* for each sleeve. The front jaws of each pair

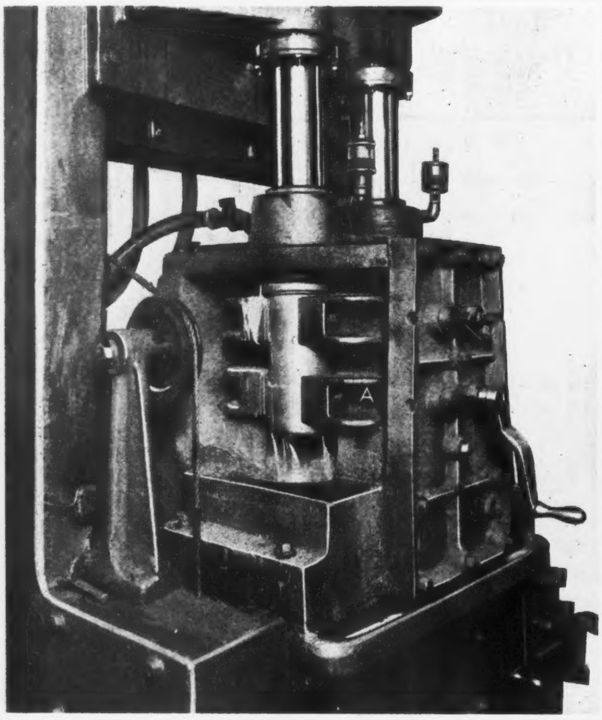


Fig. 1. Rough-boring Two Cylinder Sleeves simultaneously on a Two-spindle Vertical Machine

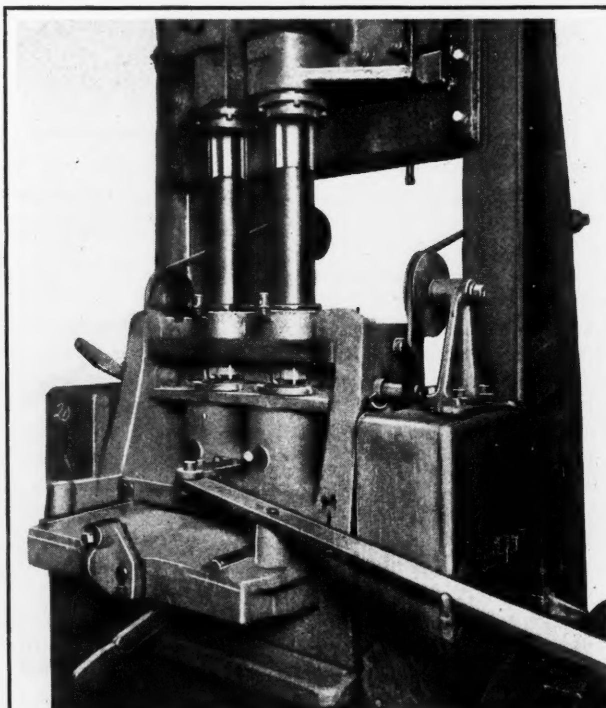


Fig. 2. Jig used in reaming the Bore of Two Cylinder Sleeves at One Time

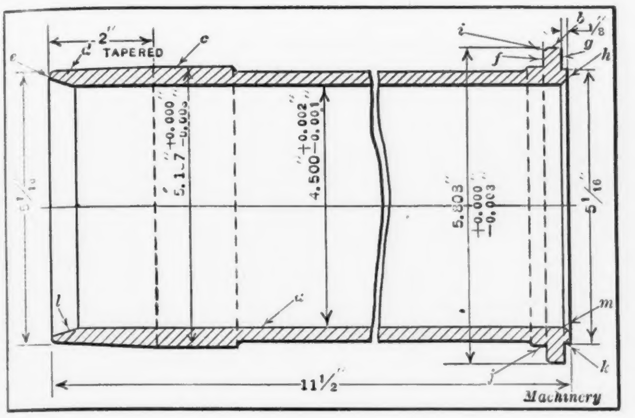


Fig. 3. Design of the Cylinder Sleeve used in the Engines of International Harvester Co.'s Tractors

are opened and closed by applying a crank to the square ends of shafts *B*, which project from the front of the jig. Boring of the sleeves is accomplished by feeding the machine table and the jig to the boring tools. Coolant is delivered copiously to the tools through holes in the rear of the jig. Bushings in the jig guide the boring-bars, and it will be obvious from the illustration and description that it is unnecessary to withdraw the tools from these bushings for reloading the work.

The second operation consists of taking rough-turning and rough-facing cuts on the various external surfaces of the sleeve. This is done in a Reed-Prentice production lathe equipped with the tooling illustrated in Fig. 4. Two of these machines are used for this operation, so as to keep up with the rough-boring machine. Surface *b*, Fig. 3, is turned by a tool in block *C*, Fig. 4, of the front carriage, while straight surface *c* is turned by tool *D*. The tapered surface *d*, Fig. 3, is machined by means of a tool held in block *E*, Fig. 4. As the carriage is fed to the left, this block is drawn outward at the proper rate to suit the taper, by two guides *F*, which are set at the required angle. The guides are attached to a bracket that is fastened to the ways of the bed. At the same time that these cuts are being taken by the tools of the front carriage, four tools held in the back arm *G* are rocked forward to face surfaces *e*, *f*, *g*, and *h*, Fig. 3, and to rough-turn surfaces *j* and *k*. The rocking of the back arm is synchronized with the longitudinal movements of the carriage. Stops are provided to limit the carriage movements.

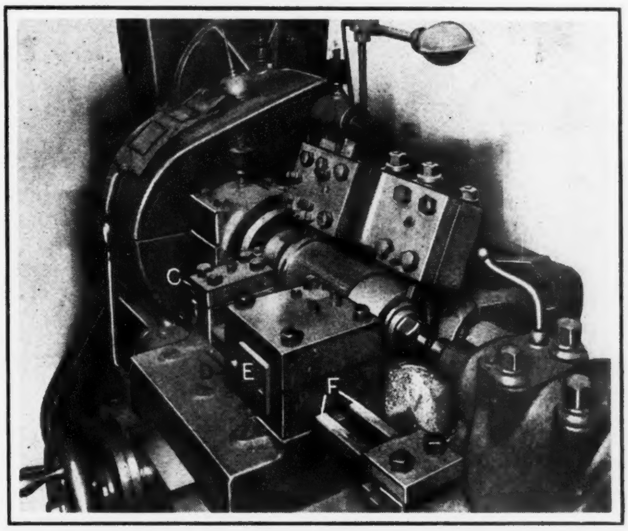


Fig. 4. Tooling Equipment used in taking the Rough-turning and Rough-facing Cuts on the Sleeve

An expansion arbor of interesting design, which is used for holding the cylinder sleeve between the centers of this lathe, is illustrated in Fig. 5. This arbor grips the work by means of shell *H*, which is provided at both ends with a serrated cylindrical surface. Shell *H* is split lengthwise from each end so that the serrated surfaces are expanded against the bore of the cylinder sleeve when taper sleeve *I* and the left-hand taper end of arbor *J* are drawn into the shell by tightening nut *K* on the arbor. A coil spring located in the space between the shell and the arbor pushes taper sleeve *I* and the left-hand end of the arbor apart when the nut is loosened.

For convenience in loading a sleeve, the arbor is held vertically by inserting the left-hand end into a flanged loading ring which is fastened to a bench located in front of the lathe. The loading ring is provided with a slot into which the rectangular tang *L* is inserted. When the cylinder sleeve is slipped on the arbor, the flanged end of the sleeve rests against the top of the loading ring so as to locate the sleeve properly on the arbor with regard to length. When the loaded arbor is placed between the centers of the lathe, the rectangular tang *L* engages a slot in the faceplate of the machine to drive the arbor and the work.

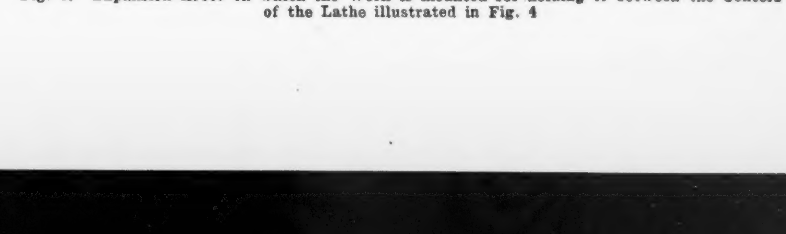


Fig. 5. Expansion Arbor on which the Work is mounted for holding it between the Centers of the Lathe illustrated in Fig. 4

Finish-boring and Reaming Operations

The third and fourth operations consist of finish-boring and reaming, respectively, to the grinding size, bore *a*, Fig. 3, of the sleeve; both of these operations are performed in vertical machines similar to that illustrated in Fig. 1, but provided with jigs of the design shown in Fig. 2. In the third operation, the hole is bored to 4.468 inches in diameter, and in the fourth operation, it is reamed to 4.490 inches in diameter, leaving sufficient stock for grinding. The lower end of the sleeves in both operations is held concentric with the tool-spindle, by being slipped into a bushing that seats the straight cylindrical surface *c*, Fig. 3. Surface *f* of the sleeve flange rests on a surface of the fixture, and this end of the sleeve is located concentrically with the corresponding tool-spindle by means of a ring which contacts with periphery *b* of the flange. This ring is slotted to permit clamps to be fastened at *f* and *g*, to prevent the sleeve from turning in the fixture. As in the rough-boring operation, the sleeves are bored or reamed, as the case may be, by feeding the table upward.

To save time in reloading, the jig is made in two sections, one of which is held stationary on the machine table; this section holds the bushings which guide the tools through the work, and is provided with a flat way and a vee. The second section of the jig holds the sleeves, and can be slid back and forth on the ways of the stationary part by simply operating lever *M*, Fig. 2. With this construction, it is only necessary to raise the tools slightly above the work, but not out of the bushings in the stationary part, and pull the jig slide to the front, when it is desired to reload the sleeves. When work has been placed in the sliding member, handle *M* is operated in the reverse direction to push the jig slide against adjustable stop-screws at the back which locate the slide approximately. Then the handle beneath the slide is raised, causing a plunger-pin to enter a locating hole in the slide, thus positioning it accurately to suit the operation.

Finish-turning and Finish-facing

The various external surfaces of the sleeve which were rough-turned and rough-faced in the operation illustrated in Fig. 4, are finish-turned and finish-faced in another Reed-Prentice production lathe. Again the work is held on an

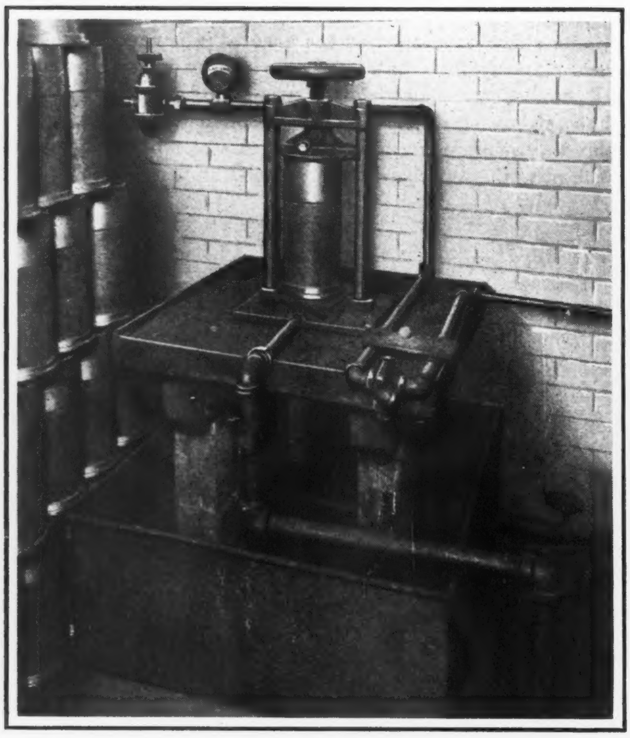


Fig. 6. Equipment employed in testing the Cylinder Sleeves for Leakage

expansion arbor similar to that shown in Fig. 5, with the exception that the gripping ends of the expansion shell are practically smooth, because they contact with the reamed bore of the sleeve. Three tools are used on the front carriage for finish-turning surfaces *b*, *c*, and *d*, Fig. 3, as in the previous case, but there are five tools on the back arm for finish-facing surfaces *e*, *f*, *g*, and *h*, for finish-turning surfaces *j* and *k*, and for chamfering corner *i*.

Testing for Leakage

Since the sleeves are iron castings, it occasionally happens that spongy spots exist that would permit water to leak through on a piston if a sleeve with such a defect were assembled into an engine. Hence, it is wise to test each sleeve for leakage, and this is done immediately after the preceding step, when most of the stock has already been removed and any leaky spots will generally have been uncovered. This leakage test is conducted by means of the equipment illustrated in Fig. 6. The sleeve is clamped vertically between two rubber gaskets, and then the water is forced into it from the bottom at a pressure of from 65 to 90 pounds per square inch. In this test any leakage at once becomes visible.

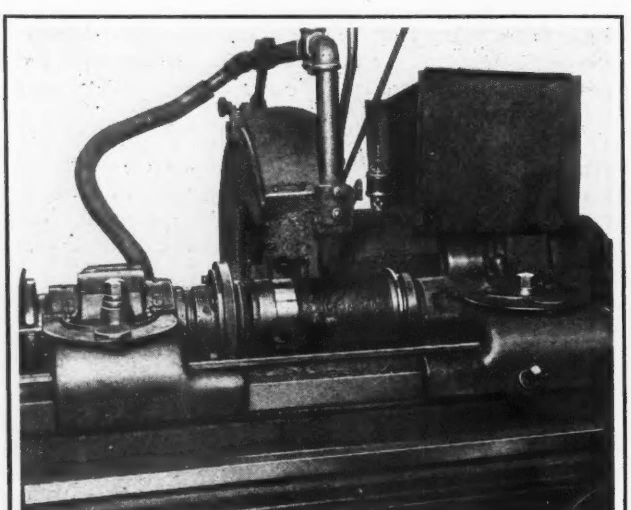


Fig. 7. Grinding Two External Surfaces in a Standard Cylindrical Grinding Machine

Grinding Externally and Internally and Chamfering the Ends

The next operation, which consists of grinding the straight surface *c*, Fig. 3, and periphery *b* of the flange, is illustrated in Fig. 7. On the headstock spindle of the cylindrical grinding machine in which this operation is accomplished, there is a taper nose on which the bottom end of the sleeve is seated. A second taper nose mounted on the tailstock spindle is then advanced into the opposite end of the sleeve bore by revolving the tailstock handwheel. The two taper pieces thus locate the work concentrically with its bore. The tailstock piece is mounted loosely to permit it to revolve with the work. A small spring ring is clamped on the work near the headstock end to engage a dog on the faceplate for driving the sleeve. The operator grinds the two surfaces in accordance with limit snap gages.

Both ends of the sleeve are next chamfered at *l* and *m*, Fig. 3, by means of the equipment illustrated in Fig. 8, which is set up on a drilling machine. In this illustration, the operation on chamfer *l* is about to start, the flange at the opposite end of the sleeve being centered with the tool by

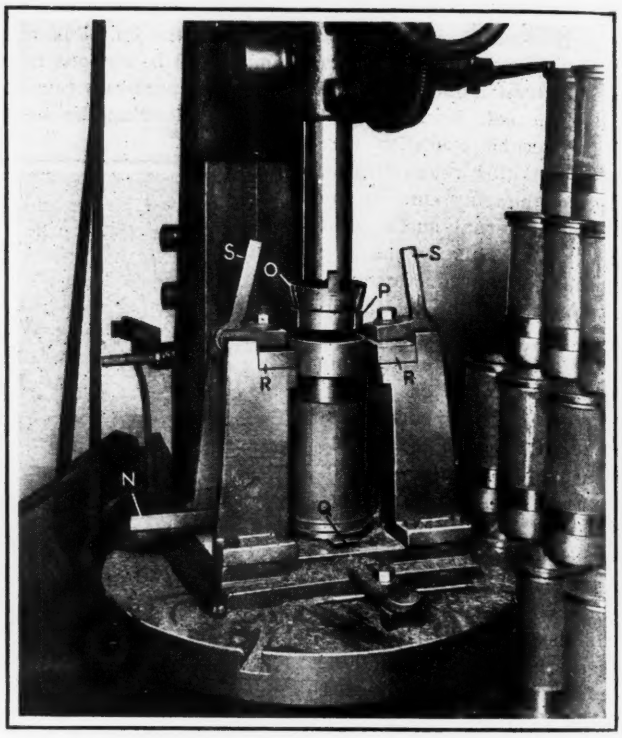


Fig. 8. Tooling provided for taking a Chamfering Cut on Each End of the Sleeve concentrically with the Bore

means of accurate blocks *Q*, while the tapered surface at the uppermost end of the sleeve is located between two blocks *R*. Lever *N* is operated to bind the flange of the sleeve and prevent the work from turning during the operation. Cutter *O* is provided with inserted high-speed steel blades which are ground at the proper angle to suit the chamfer, and is equipped with a straight pilot *P* which enters the reamed bore of the sleeve. When the sleeve is reversed in the fixture for cutting chamfer *m*, Fig. 3, the two handles *S*, Fig. 8, are operated to advance jaws and bind them on the flange of the sleeve which is uppermost. Blocks on the fixture again hold the bottom end of the sleeve in alignment.

Rough- and finish-grinding operations are performed on the bore of the sleeve in Bryant chucking grinders, of which there is a battery of six in the department. In both the rough- and finish-grinding, two cuts are taken, from 0.008 to 0.010 inch of stock being removed on the diameter in the rough-grinding, and from 0.002 to 0.003 inch in the finish-grinding. The finish-grinding operation is illustrated in Fig. 10.

In both of these operations, the sleeve is entered into a chuck where it seats on the external ground surfaces *b* and *c*, and face *f*, Fig. 3, and is clamped on face *g* so that it does

not turn during the operation. The production of each machine ranges from 90 to 100 sleeves per day.

Inspecting for Concentricity and Size

When the sleeves reach the inspection department, they are carefully examined to see that there are no chatter marks or other defects on the finished surfaces. The bore is readily examined by tilting the sleeve over an electric light. Snap gages are then employed for checking the various external diameters and thicknesses, after which the concentricity of the various surfaces is determined. For checking the concentricity, the equipment shown in Fig. 11 is used. In this inspection, the two ground external surfaces of the sleeve are seated in V-blocks *T*, which permit the sleeve to be easily revolved while indicator *U* is in contact with any internal or external surface. The indicator is first used in the bore as illustrated, and it will be obvious that the length of the rod to which the indicator is attached permits of inspection at different points along the bore. The indicator is then applied against faces *f* and *g*, Fig. 3, of the flange, and

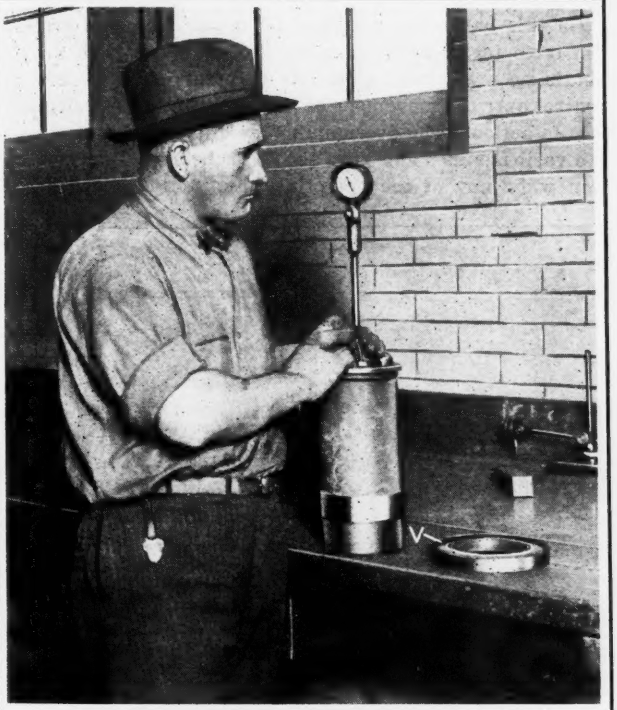


Fig. 9. Determining the Exact Diameter of the Bore at Any Point and the Amount of Out-of-roundness

the sleeve revolved to determine whether or not these faces are at right angles with the bore. The periphery of the sleeve flange and other surfaces at either end of the sleeve can be similarly checked for accuracy.

The sleeve bore must be true to size within plus 0.002 inch and minus 0.001 inch, and must not be out of round more than 0.0005 inch or taper more than 0.0005 inch in the entire length. For determining the diameter and the out-of-roundness, use is made of a Federal three-point indicator gage, as illustrated in Fig. 9. The three points of this gage are first expanded against the inside surface of ring gage *V*, and with the points thus expanded, the indicator dial is set to read zero. The three points of the indicator gage are then entered into the bore and revolved and moved vertically along it. In this way, the amount of error in the diameter at any point, or the amount of out-of-roundness can be ascertained.

* * *

TRUING AND DRESSING

"Truing" means the removal of material from the grinding face of a wheel so that the resulting surface runs absolutely true. "Dressing" is the operation of cleaning or opening up the grinding face of a wheel and does not necessarily leave the surface true.—*Grits and Grinds*

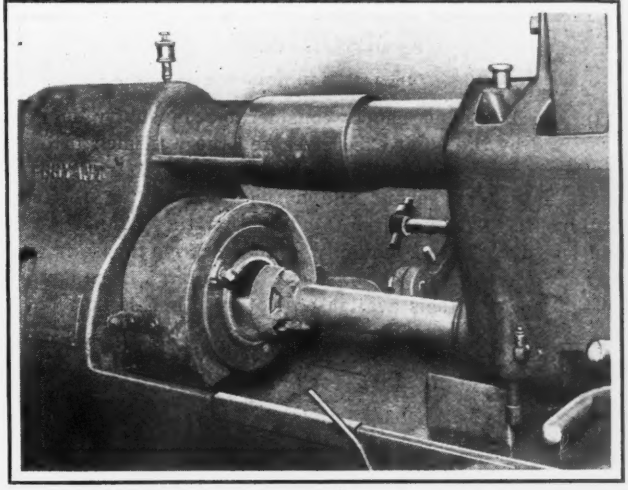


Fig. 10. Last Machining Operation, which consists of finish-grinding the Bore

CAPITAL OF THE AUTOMOBILE INDUSTRY

According to information published by the National Automobile Chamber of Commerce, 366 Madison Ave., New York City, the total capital employed in the automobile industry amounts to about $2,200,000,000, of which 44 per cent represents capital stock, approximately the same percentage surplus and reserves, while only 1.7 per cent is represented by long-term bonds, and 10 per cent by short-term notes and other short-term obligations. In this connection, it is of interest to note that the capital of the automobile industry is approximately one-half that of the steel industry, which is over $4,600,000,000. The capital of fifty of the larger parts and accessories manufacturers amounts to about $420,000,000, and seventeen of the automobile body manufacturers employ capital amounting to $236,000,000. The net profits of the automobile industry as a whole, in 1924, were about 15 per cent, this high figure being due largely to the rapid inventory turnover in this industry, which is 6.3 times a year. In the steel industry, this turnover is approximately 3.86 times per year.

* * *

Several firms engaged in the manufacture of railway locomotives in Germany have found it necessary to suspend operations or to greatly restrict their production because of lack of orders. The most disquieting factor is that the German State railways have about 5000 engines not required to handle present traffic, although a large percentage of these, it is stated, are out of date and ought to be scrapped. There is also a surplus of railway cars, and hence, no prospects for new domestic orders in that field. The export outlook is also said to be very discouraging.

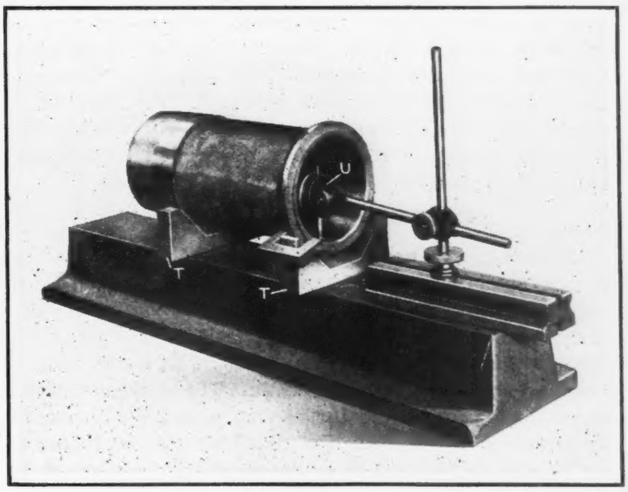


Fig. 11. Equipment used in the Inspection Department for checking the Concentricity of the Various Surfaces Relative to Each Other

HANDLING HEAVY WORK ON SMALL MACHINES

By JAMES H. RODGERS

In small jobbing shops, considerable ingenuity is often exercised by the plant executives and the workmen in devising ways and means for machining work that is of an unusual nature or beyond the normal capacity of the shop equipment. Few men like to admit that they cannot handle odd jobs of this kind, and only in an exceptional case is work turned away for the reason that it is too large to be handled on the machine tools available. Not only is this true of the ordinary jobbing shop, but very often the same conditions apply to a manufacturing concern. The class of work that is sometimes handled in emergency cases where the plant superintendent, foreman, or workmen have the necessary initiative is often remarkable.

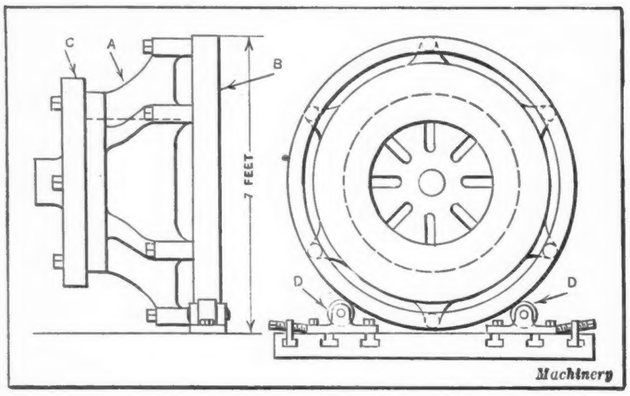


Fig. 1. Overhanging Work on Gap Lathe supported by Rolls

In devising methods of handling work that is seemingly beyond the capacity of a machine, the actual performance of the machining operations is not the only factor that should be given consideration. Too frequently the effect of overloading on the parts of the machine is not taken into account.

All machine tools are designed to function properly when employed for work within a specified range. When required to go beyond this limit, stresses are created that were not provided for in building the machine. Therefore it is always advisable to determine, as far as possible, what the effect will be on the machine when work of exceptional size or shape is to be handled. In some cases, the machine may be operated within its working range so far as the machining cut is concerned, but on account of the shape of the piece, certain sections of the machine may be subjected to temporary stresses that may eventually affect the accuracy of the machine.

The proper distribution of weight is a very important detail in the machining of heavy work, especially in cases where the work is fed to the cutter or tool, instead of the tool being fed to the work. When a large casting or forging rests upon the table or bed of a machine, the table should move almost as freely as when unloaded. The slides should be thoroughly cleaned and well lubricated. The weight should be located so that the center of gravity is as near the source of support as possible.

Using Rollers to Support Lathe Work

The unusual job necessitates employing unusual methods. As an example, the writer has in mind a job handled some time ago, which necessitated the raising of the headstock of a gap bed lathe about 6 inches. The lathe was fitted with ordinary change-gears, and an auxiliary stud was provided to connect up the gears in this train. The work consisted of machining the frame and thrust ring of a 7-foot tire setter. The assembly base *A*, Fig. 1, of the tire setter, including the ring *B*, was required to be mounted on the faceplate *C*, but trouble was experienced almost as soon as the tool was advanced to the work. The rear bearing-cap screws failed to hold, and the fact that the work just cleared the floor was all that prevented serious damage. Repairs were made, and in order to maintain the alignment of the spindle, a heavy timber was placed between the rear bearing and the ceiling.

Machining operations were again started, but excessive chatter necessitated the delay of a day or two while rollers and brackets were made and mounted on the floor-plates to support the excessive weight of the ring and heavy portion of the tire-setter frame, which, together, weighed over a ton. With the rollers *D* in place, as shown in Fig. 1, no further difficulty was experienced.

Extension Plate for Die-sinking Machine

On another occasion, a large die was required to be sunk, using a small die-sinker and miller for the machine work which was considerably smaller than should have been employed for this particular job. It was first necessary to make an auxiliary plate to serve as an extension to the regular table, in order to provide adequate support for the work. The sliding members were subjected to stresses, however, that made it very difficult to employ the feed-screws, and it was decided to adopt some method of relieving the slides from this surplus weight.

On this particular machine, no power feed was available, the table travel being obtained by hand feed. In order to obtain accurate results, it was necessary to have complete control over the movement of the work while the cutting tool was in action. The overhanging weight placed a stress upon the various slides and gibs, the effect being a "jumping" motion when any of the operating handles were turned. Not only was it difficult to obtain uniform cutting action, but the possibility of affecting the accuracy of the lightly constructed machine was a factor that required careful attention. However, it was necessary to perform the machining operations on the tool selected, as it was the best one available for the job.

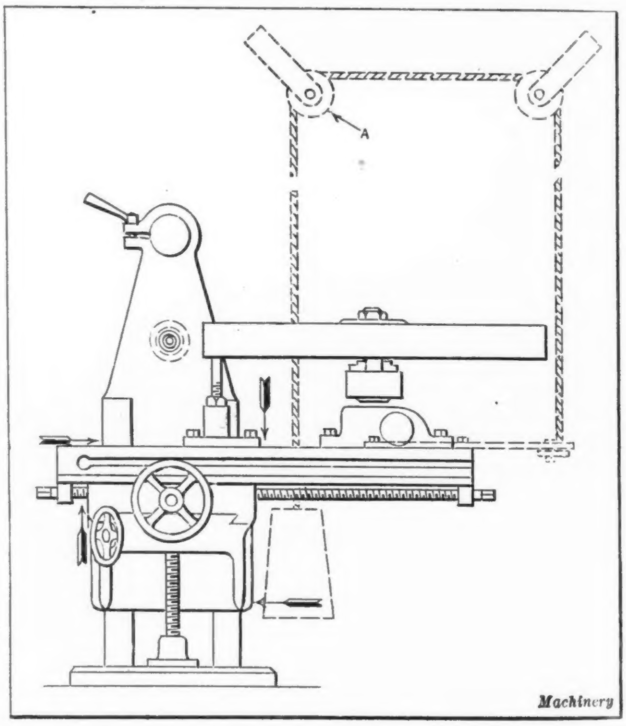


Fig. 2. Method of balancing Overhanging Work on Milling Machine Table

Owing to the constant movement of the work, in both a vertical and a horizontal direction, it was impossible to provide a satisfactory floor support. It was therefore decided to locate a pair of small grooved pulleys on the ceiling, over which a light cable could be used with a weight to counterbalance the work. With this arrangement, it was found that the slides moved almost as freely as when working with no load on the table. The cable and counterweight became a permanent accessory of this machine and were subsequently used to advantage many times.

Compensating for Milling Machine Table Overhang

A typical set-up in which the milling machine is subjected to excessive stresses, caused by extreme overhang of the work on the table, is shown in Fig. 2. This set-up is a reproduction of one seen by the writer some months ago in a technical journal, illustrating a description of the method used in cutting a large gear on a small milling machine. In this particular instance, the gear was described as being 30 inches in diameter with a 2 1/4-inch face, and weighing not less than 200 pounds. This weight was at a point some distance from the center of the support. The work called for the cutting of 148 teeth of 5 diametral pitch. This necessitated elevating and lowering the table at least 148 times during the process of cutting the gear teeth. If roughing and finishing cuts were taken, the cycle of movements would, of course, be doubled, making a total of nearly 600 passes or movements vertically through a distance of about 3 inches, allowing for over-travel to permit cutter clearance.

Apparently the work was performed satisfactorily, but a glance at the illustration will show clearly that this set-up would exert abnormal stresses upon the vertical slides, especially when the table was in motion. The heavy arrows —added for the purpose of bringing out the writer's comments—show the direction of excessive thrust as a direct effect of the work location. In addition to the weight of the knee, table, and work, the elevating screw also was required to overcome the resistance of the binding action—a condition that would be greatly emphasized if the ways were not adequately lubricated.

In the experience of the writer, this particular job could have been more efficiently performed had the operator devised some means of relieving the slides of the abnormal stresses. The dotted lines show a simple method of counterbalancing the work that would facilitate the free movement of the different slides under this and similar conditions. The counterweights could be located so as not to interfere with the operator or nearby machines, by placing pulley *A* in the proper position.

While a liberal factor of safety is usually employed in designing machine tools, the unusual stress to which a machine is sometimes subjected as a result of out of the ordinary applications must be considered. When such demands are made on a machine tool, it should be the duty of the one handling or directing the work not only to see that the work is successfully performed, but also to prevent the machine from being injured or unduly stressed during the machining operation.

* * *

A. S. M. E. REPORT ON LIMIT GAGES

The American Society of Mechanical Engineers has published in pamphlet form the first report of the sectional committee on the standardization of plain limit gages for general engineering work. Eugene E. Peck is chairman of this committee. The text part of the report covers the fundamentals of gaging operations of plain and cylindrical surfaces, and contains the definitions of the terms employed in gaging practice. It also includes numerous illustrations of the various types of ring, plug, snap, and special gages. The classification of the fits adopted by the committee is then described, after which follow twelve carefully prepared tables of standard limits for various sizes and diameters from 0 to 7 1/2 inches. The report may be obtained from the American Society of Mechanical Engineers, 29 W. 39th St., New York.

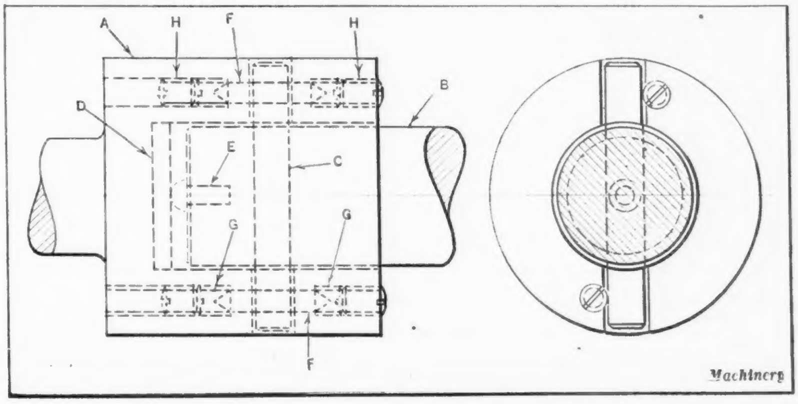
FLOATING REAMER-HOLDER

By S. FRENCH

The question as to whether the finishing of cylinder bores of internal combustion engines by grinding or honing is productive of the highest results is still a matter of controversy, since both methods possess advantages. Irrespective of which method is used, the reaming operation has an important bearing on the accuracy and finish of the bore, especially with regard to parallelism and roundness. The demands for accurate reaming are not so great when the bore is ground as when it is finished by honing, because the grinding wheel will correct inaccuracies in the reamed hole. Nevertheless, the time spent in grinding depends considerably upon the quality of the hole produced in the reaming operation. A minimum "grinding stock allowance" is possible only when the reaming is accurate as to size, roundness, and straightness.

When a bore is reamed and honed, the demand for efficiency of the reamer equipment is much more exacting, for the reason that unless the reamed bore is within the specified tolerance, particularly as to being cylindrical, it is almost impossible to correct it by honing. In other words, a honed cylinder is just as good as the reaming standards permit. It must be within the prescribed limits prior to the honing operation; otherwise the error will remain after honing.

In order to obtain the best results in reaming cylinder bores, the alignment of the machine used must be reasonably correct. To offset any error that may exist, floating adapters must be used, that will permit the reamer to follow the bored hole. Many adapters are wrongly classed "floating," as they do not have a universal floating action at right angles to the axis of the spindle to permit the reamer to follow the hole and thus eliminate any tendency to enlarge the front and rear ends and make the hole bellmouthed. It is also often assumed that a reamer hinged on a universal joint connection near the spindle nose or turret has all the necessary characteristics for a proper float. Such is not the case as long as the end of the reamer shank is not permitted a free radial or lateral movement in any direction.



Construction of Floating Adapter for holding Cylinder Reamers

The floating adapter shown in the accompanying illustration has given excellent results, for the reason that frictional surfaces are reduced to a minimum the moment the reamer starts cutting. Cylindrical body *A* is bored inside to give a reasonable clearance for the reamer shank *B*. In the majority of cases, from 0.015 to 0.020 inch is sufficient clearance. A driving pin *C*, which is driven into shank *B*, extends through two slots machined in body *A*. Assembled at the inner end of the reamer shank is a hardened and ground steel disk *D* against which a spherical headed stud *E* bears. This stud is hardened and pressed into a hole in the shank end of the reamer. Two hardened steel rolls *F* having conical ends are held in position in the body by two headless screws *G* which have hollow vee ends to fit the ends of the rolls. These screws are locked in place, after rolls *F* have been adjusted, by means of headless screws *H*.

When a reamer held by means of this adapter enters a hole, the spherical head of stud *E* comes in contact with the ground surface of disk *D* which takes the thrust. The resistance of the cutting action is taken by driving pin *C* bearing against rolls *F*. The contact makes these rolls revolve, and their rotary action prevents the reamer from being held rigidly and permits it to adjust itself when it enters the hole. No difficulty has been experienced with this reamer in maintaining holes accurate as to parallelism and roundness.

A Vertical Automatic in a Hardware Plant

Manufacturing Door-lock Cylinders and Plugs

DOOR-LOCK plugs and cylinders of the types illustrated at *A* and *B*, respectively, in Fig. 1, are produced at high rates of production by methods to be described in this article. These parts are made in four different sizes, in which the cylinder dimension *X* is 53/64, 1 3/32, 1 3/8, and 1 5/8 inches, respectively, within plus or minus 0.015 inch. In each case plug dimension *Y* depends upon dimension *X* of the cylinder. In the different operations performed on these pieces, the production averages one piece every 17 seconds, the output being limited only by the ability of the operator to reload the machine, which is what is known as the "Super-matic" multiple-spindle machine built by the Acme Machine Tool Co., Cincinnati, Ohio. This machine is in reality a vertical turret lathe, and is capable of drilling, reaming, counterboring, facing, turning, tapping, and threading a large variety of parts. The work-table is intermittently indexed from right to left beneath the spindles, and is fed vertically to bring all pieces of work simultaneously to the tools. The upward feed is accomplished at a slow rate, and at the end of this movement there is a quick drop to clear the tools for indexing. The number of spindles and work-holding chucks may be varied to suit the job.

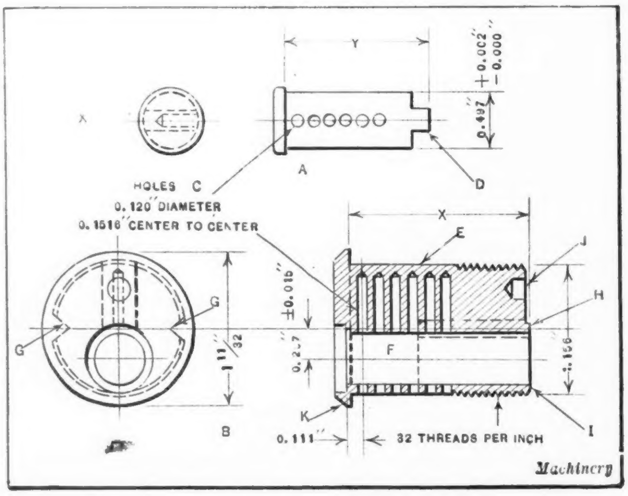


Fig. 1. Details of a Door-lock Cylinder and its Mating Plug

In making the lock cylinders and plugs, it is important that holes *C* be produced accurately so that the holes of both parts will be in close alignment when the plug is assembled in the cylinder. Small spring-actuated pins of various lengths are assembled in the holes in the cylinder, and normally extend into the holes in the plug; these pins prevent the plug from being turned in the cylinder, and thus lock the door. When the proper key is inserted into a slot that is later machined lengthwise through the plug, the irregular edge of the key which contacts with the pins is proportioned to raise each pin in line with the periphery of the plug. Then the plug may be revolved by means of the key, causing tongue *D* to release the bolt that keeps the door locked. Conversely, when the plug is revolved by means of the key to bring the holes in the cylinder and plug in line again, the door will be locked and the pins will rise into the holes in the plug, so that it will stay locked after the key has been withdrawn.

First and Second Operations on the Cylinder

For the various operations to be described, the machine is equipped with eight spindles; in the first of these operations, all the spindles are used. There are nine indexed positions of the work-table, one of which is an idle station at which point the work is reloaded. This station is illustrated at *O*, Fig. 2, where it will be seen that the chucks are equipped with two jaws. These jaws are conveniently opened

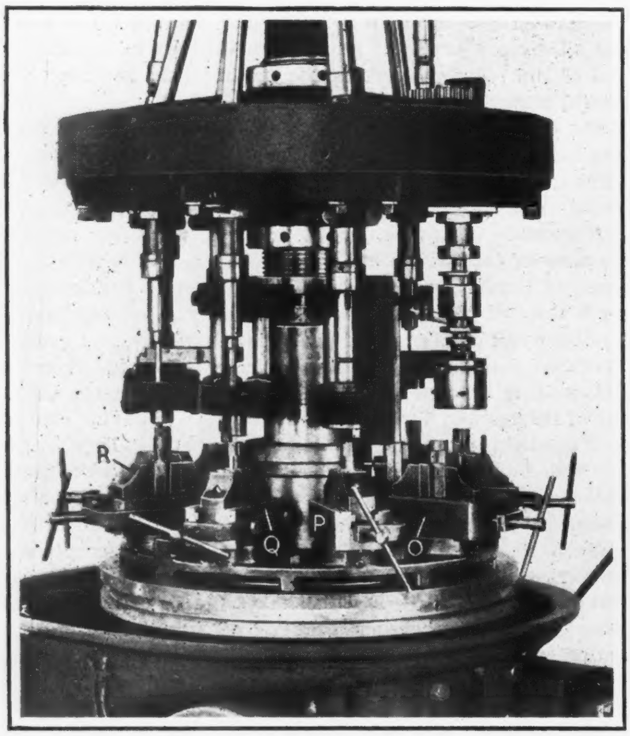


Fig. 2. Loading and First Three Spindle Stations in the First Operation on the Door-lock Cylinder

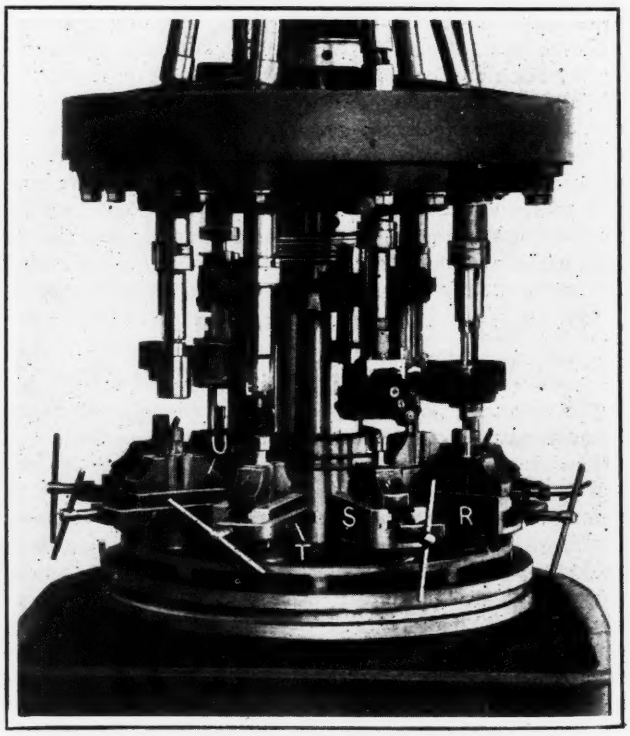


Fig. 3. Third, Fourth, Fifth, and Sixth Spindle Stations in the First Operation on the Cylinder

and closed by means of a wrench permanently attached to each chuck. The cylinder is gripped by the flange and located by means of a small lug cast on the flange face but which is not shown in Fig. 1. At station *P*, Fig. 2, surface *E*, Fig. 1, of the cylinder, is turned the entire length by means of a hollow-mill which is rotated in an arm fastened to the central column of the machine. This arm insures adequate support of the tool at the point of cutting. The cutters of the hollow-mill are adjustable for diameter, and the guiding arm is adjustable for height.

After the cylinder has been indexed to station *Q*, hole *F*, Fig. 1, is drilled off center for the plug. A feature of the tool provided at this station is a bushing which slips over surface *E* of the work when the table is raised for the operation. This bushing is counterbored to permit guiding the drill accurately, and it is held in a second arm fastened to the central column of the machine. At station *R*, Fig. 2, a reamer is employed which finishes hole *F*, Fig. 1. The reamer is guided by a bushing in the same manner as the drill, and this bushing is also held in an arm fastened to the column of the machine.

A milling device of interesting design is employed at station *S*, Fig. 3, for milling a V-groove *G*, Fig. 1, on each side of the cylinder. There are two cutters mounted in a housing that remains stationary, but the cutters are driven from the spindle of this station through bevel and spur gears. A bushing at the center of the milling device slips over the work to support it during the cutting. There is an in and out adjustment of the cutters to regulate the depth of the V-grooves.

Boss *H*, Fig. 1, is turned and faced, and the adjacent surface faced, by three cutters held in the spindle of station *T*, Fig. 3. The holder of these tools is provided with a pilot which enters hole *F*, Fig. 1, of the cylinder when the work-table rises, and insures that the boss will be turned concentrically with the hole. Corner *I* of the cylinder is chamfered at station *U*, Fig. 3, by means of cutters in a holder that slips over the work. At station *V*, Fig. 4, the 3/16-inch hole *J*, Fig. 1, is drilled off center by means of tooling similar to that used at station *Q*, Fig. 2, with the exception that the drill is of smaller diameter. Finally, at station *W*, Fig. 4, the work is fed upward into a rotary die-head which cuts threads on the right-hand end of surface *E*, as illustrated in Fig. 1.

After the operations just described have been performed on a large quantity of cylinders, the machine is tooled up

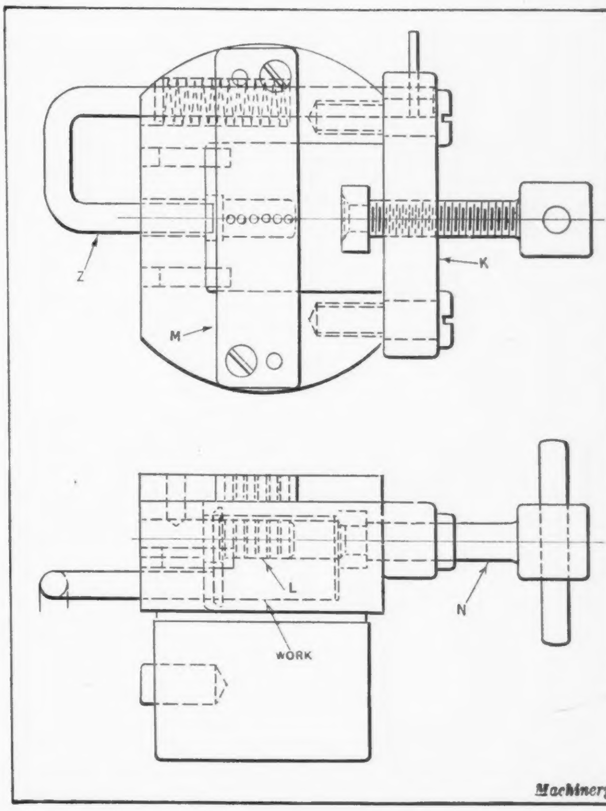


Fig. 5. Work-holding Fixture employed in drilling the Pin Holes in the Lock Cylinder

for the second operation. Only four of the spindles are equipped with tools, and the same chucks are used as before, but other jaws are substituted for holding the cylinders with the flanged end projecting. Each piece of work is gripped on surface *E* in back of the thread and located by means of a stud that enters hole *F*. A slot in one of the jaws keeps the piece from turning under the pressure of the cut. At the first station, hole *F* is counterbored at the flanged end by means of a piloted tool that is guided in hole *F*. The depth of the counterbore is held within plus or minus 0.001 inch, and this accuracy is maintained through a fine vertical adjustment that is provided for the spindle carrier.

In the second step on this end of the cylinder, periphery *K* of the flange is turned by cutters held vertically, and in the third step, the flange is chamfered. Finally, a wide-faced cutter is used to "sweep" or face the flange.

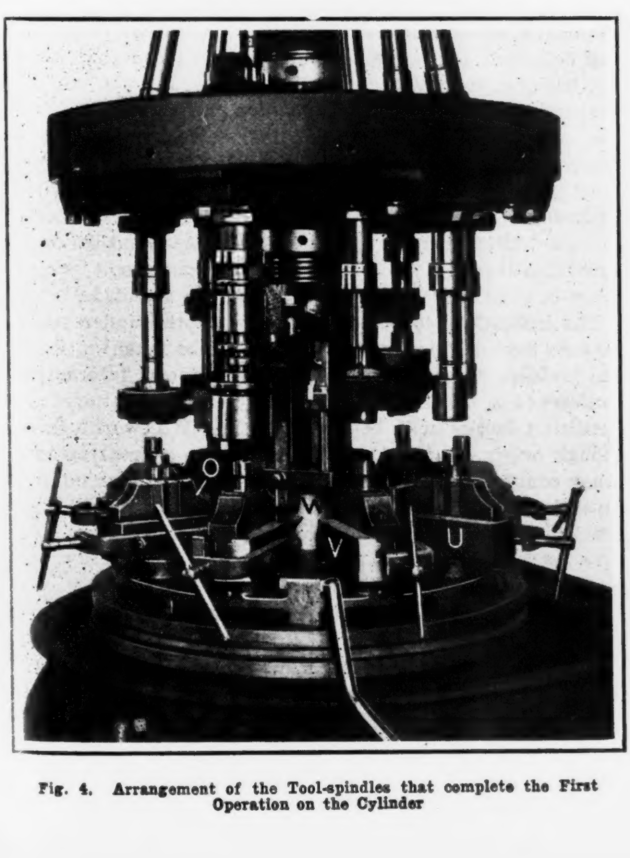


Fig. 4. Arrangement of the Tool-spindles that complete the First Operation on the Cylinder

Drilling the Small Pin Holes

Holes *C*, Fig. 1, are drilled one at a time as the lock cylinder is indexed around the "Super-matic" in a third chucking. The work is held horizontally for this operation, as illustrated in Fig. 5, being located from the counterbored seat of the plug hole. Six spindles of the machine are employed, and each successive spindle is offset, relative to the preceding one, an amount equal to the center-to-center distance between the holes to be drilled. In this operation, the drills are driven at a speed of 2000 revolutions per minute.

In loading the work-holding fixtures, the hinged bar *K* is swung upward to permit sliding the lock cylinder on stud *L*. This stud has holes in it through which the drills extend to produce the holes in the major portion of the cylinder. Plate *M*, likewise, has a series of holes in it to guide the drill through the work. When the cylinder has been slipped on stud *L*, the hinged bar is locked in place, and clamp *N* revolved to tighten the work on the stud. At the end of an operation, bar *Z* is pulled forward to force the cylinder off the stud.

Plug *A*, Fig. 1, is produced in a screw machine, complete, except for drilling holes *C*. These holes are produced on the "Super-matic" with the machine spindles arranged in the same manner as for drilling the corresponding holes in the cylinder. The work fixtures also follow the design of those

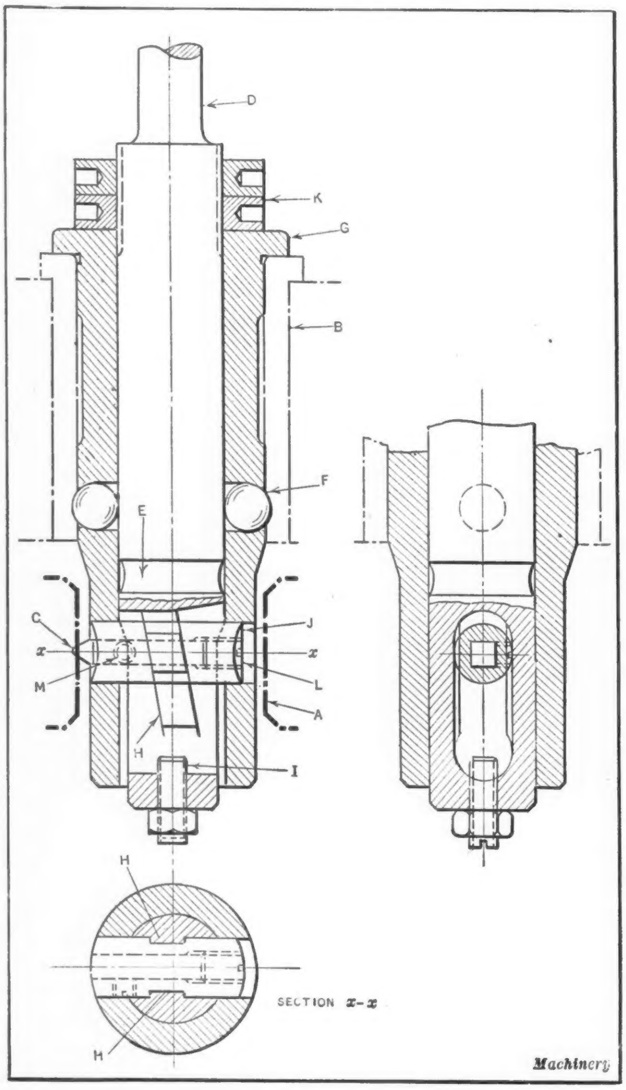
used with the cylinder, but the plug is held in a sleeve or bushing. It is located in this bushing by the under side of the shoulder which registers with the counterbored seat of the cylinder when the cylinder and plug are put together. This method of locating the plug for drilling the holes, in combination with the method of locating the cylinder by means of the counterbored seat for drilling the corresponding holes, insures the alignment of the holes in the two pieces when they are assembled.

* * *

TOOL FOR CUTTING OIL-GROOVE IN CONNECTING-ROD

By HERMAN ORTEGREN

In the accompanying illustration, is shown an expanding type of tool, designed for use in cutting a circular oil-groove in the babbitt bushing of a connecting-rod. The tool is employed on a drilling machine in connection with a fixture designed to hold the connecting-rod and to guide the tool while the grooving operation is being performed. The dot-and-dash lines at *A* show the outline of the babbitt bushing, and the lines at *B* show the pilot bushing which guides the tool. The illustration shows the tool-holder with the groove-cutting tool *C* in its extreme outer or expanded position.



Tool for cutting Oil-groove in Connecting-rod

When the tool is withdrawn, the spindle *D* moves upward until the groove *E* is opposite the steel balls *F* in bushing *G*. During this movement the tool-holder *J*, with the cutting tool *C*, is withdrawn from its cutting position by the two keys *H* which are cut in holder *J* at an angle with the axis of the spindle. A groove is cut in the pilot bushing *B*, which allows balls *F* to just clear spindle *D*, and thus keep bushing *G* from following the spindle until the set-screw *I* engages holder *J*, at which time the balls are forced to snap into the groove *E* in the spindle. As the upward movement of the spindle continues, the steel balls *F*, being drawn above the groove in bushing *B*, serve to lock bushing *G* to spindle *D*, so that both of these members can be moved up far enough to enable the work to be removed.

Tool-holder *J* slides in bushing *G*, and serves to drive the latter member, the same as though it were a part of spindle *D*. When the spindle is fed down, it carries bushing *G* with it until the shoulder on *G* strikes the pilot bushing *B*. Balls *F* then move outward into the groove in bushing *B*, and thus disengage the spindle from bushing *G*. This brings the tool *C* into the proper position for the grooving operation. Spindle *D* continues to move downward, feeding tool *C* outward until the stop-collar *K* comes in contact with bushing *G*. The stop-collar provides a simple means for adjusting the depth of the groove.

Set-screw *I* prevents tool-holder *J* from reaching the bottom of the slot in the spindle, where there would be a possibility of the tool-holder getting out of alignment with the keys *H*. The lower ends of the spindle keys are milled off at the bottom of the slot to permit assembling holder *J* in the slot in spindle *D*. Bushing *G* is made long enough to cover the slot in the spindle, thus preventing shavings and chips from interfering with the proper operation of the tool. The tool bit *C* is made from 1/4-inch square high-speed steel, and is held in place by an adjusting screw *L* and a set-screw *M*.

Among other desirable features incorporated in the tool described are a positive stop for the tool-holder, which acts before the cutting or feeding movement begins, and a positive withdrawal of the tool-holder before its upward movement begins.

* * *

CAN AMERICAN AND BRITISH SCREW THREADS BE UNIFIED?

The American Engineering Standards Committee and the National Screw Thread Commission have invited the British Engineering Standards Association to a conference to consider the possibility of unifying the American and British screw thread systems. Both the American and the British systems of screw threads have been the result of a long national development, the basis for the American system having been laid by William Sellers in 1864, and that for the British system by Joseph Whitworth in 1841. In so far as the number of threads per inch for the various diameters are concerned, the two national systems correspond to a large extent. A fundamental difference between the two systems exists, however, with regard to the angle of thread. This angle is 60 degrees for the American, and 55 degrees for the British thread. Another difference consists in the American thread having flattened crests and roots, whereas those of the British Whitworth thread are rounded.

The invitations have been issued with the understanding that no final decision in the matter will be taken until after the problem has been considered in a general international conference to which all of the twenty existing national standardizing bodies will be invited. The Whitworth thread, though originating in England, is used to a great extent in other countries, and has even been adopted as standard in several of these countries, which are therefore much interested in the outcome of the discussions of this subject.

* * *

The International Electrotechnical Commission, which was formed at the World's Fair in St. Louis in 1904, and whose first president was Lord Kelvin, will meet in New York City in April. Twenty-four nations are now participating in the activities of this commission. It is expected that 125 delegates will attend the meeting. Those interested may obtain further information from the secretary of the American Institute of Electrical Engineers, 29 W. 39th St., New York City.

Notes and Comment on Engineering Topics

It is estimated that, in the entire world, only about 10 ounces of radium has so far been extracted from its minerals, the value of which is about $20,000,000. Of the total quantity of radium available about one-half is in the United States, approximately 4 ounces being in hospitals and other medical institutions.

Plans are being made for the erection of a 21-story machinery building in Chicago just across from the new Union Station. The building will be managed on a cooperative basis, machinery dealers buying space in the building. The estimated cost is said to be $8,500,000, and the rentable floor space 800,000 square feet.

An oil engine designed for aircraft has recently been under trial at the Naval Aircraft Factory at Philadelphia, Pa. This engine is known as the "Attendu." The experimental model is a two-cylinder, airless-injection, self-igniting, two-stroke cycle engine, developing 125 horsepower at 1800 revolutions per minute. The engine weighs 3 1/2 pounds per horsepower.

Although the federal government has no centralized purchasing agency, it does have a centralized purchasing policy, as developed under the Bureau of the Budget and the Chief Coordinator. Purchases made for services located in the city of Washington are governed by the General Supply Committee. The list of articles for purchase include 15,000 items. The total purchases for the Government amount to over $250,000,000 per year. The largest item is food; the second, textiles; and the next, metals. Mainly at the initiation of the Association of State Purchasing Agents, and later with the cooperation of a number of national organizations interested in purchases, Secretary Hoover instituted at the Bureau of Standards, the listing and assembling of all specifications in existence in this country. These numbered over 27,000.

A dam costing $100,000 will be built and then destroyed by the Engineering Foundation Committee on Arch Dam Construction to settle various questions of dam construction which have bothered engineers for centuries. Charles David Marx, Professor Emeritus of Civil Engineering at Leland Stanford University, has been elected chairman of the committee to carry on the work. The dam will be built on Stevenson Creek, a tributary of the San Joaquin River, about sixty miles east of Fresno, Cal. Preliminary work has already begun. Engineers in many countries are cooperating. W. A. Slater of Washington, D. C., engineer-physicist of the Bureau of Standards, has taken charge of tests at the dam. Many small models of the dam will be built and tested as the work on the large dam proceeds. More than $75,000 has already been raised in the industry to finance the work.

According to *Safety Engineering*, a great tank of molten glass containing more than 35 tons of the boiling liquid recently exploded in the factory of the Technical Glass Works, Los Angeles, Cal. Almost immediately the building was enveloped in a sheet of flames, causing its destruction with a loss estimated at $300,000. When the spectacular conflagration died down, only a gaunt skeleton of steel and concrete remained of the factory, and of the interior furnishings nothing had survived but an insulated fire-wall steel filing cabinet which contained the records of the company. This filing cabinet stood in a corner of the offices, which were located on the second floor of the building. The flames burned away the floor, and the cabinet crashed to the ground below, a full 15-foot drop. When opened, it was found that all the records filed away were intact and in the same condition as when filed.

It was not until 1778 that a bridge was built from any other material than wood or stone. In that year an arch bridge with a 100-foot span was designed and built in England from cast-iron sections. It has since been recognized that the only defect in this structure lies not in the design of the arches, but in the insufficient masonry abutments. Nevertheless, the bridge is still being used. Following the construction of this bridge, a number of cast-iron bridges were built in England, all of the arch type, the early attempts being simply to use cast iron as the earlier builders had used stone. The next departure in bridge building took place about one-hundred and twenty-five years ago when Telford, after making tests of the strength of wrought iron, designed the Menai Straits suspension bridge, in which probably for the first time in the history of engineering, every part of the structure was subjected to a definite test before being used.

In calling attention to the opportunities for the engineer in materials handling, in a report presented by the Materials Handling Division before the annual meeting of the American Society of Mechanical Engineers, it was pointed out that in the mining industry, producing annually about 600,000,000 tons of materials, which at some stage are handled largely by hand shoveling, the direct labor cost is approximately $300,000,000. Loading and unloading of ships involves the handling annually of 200,000,000 tons with a probable direct labor cost of about $200,000,000. The loading and unloading of box cars represents the handling of more than 360,000,000 tons annually, mostly by hand labor. It is estimated that the direct labor cost is not less than $100,000,000, and possibly a great deal more than that. Hence, opportunities for the engineer in the development of materials handling methods and equipment are very great, and in few directions can greater savings be accomplished. The problems to be solved are both mechanical and economic.

The pipe lines used for conveying oil from southwestern and western fields to eastern points are so extensive that 1,000,000 tank cars, according to an estimate, would be required to replace them. Through these pipe lines oil is pumped from Oklahoma and Texas to eastern ports, such as Philadelphia and Bayonne, and from the Far West to the Great Lakes. The pipes used range in size from 4 to 12 inches, but 8 inches is considered standard. These pipes ordinarily are not more than 18 inches underground. The pumping stations used for moving the oil through the pipe lines are located thirty or forty miles apart, except in mountainous regions where they are much closer. The oil moves at a speed of three or four miles an hour, and the capacity of a pipe line depends not only upon the pumping pressure, but upon the temperature and viscosity of the oil. The value of the oil in a long pipe line or the "frozen liquid capital" is a very important item, since oil will not flow from the eastern end of a long line until this line is completely filled. It was necessary to pump about 500,000 barrels of oil into a 1400-mile line recently put in operation between Teapot Dome and Chicago, before oil flowed from the Chicago end. The value of this frozen liquid capital is estimated at about $800,000.

VITRIFIED BONDING PROCESS

Vitrified grinding wheels are the most widely used, especially in connection with machine-shop practice. The bond of a vitrified wheel is composed of suitable clays and fluxes which are mixed with the proper abrasives. By varying the amount and composition of the bond, wheels of different grades are obtained. An important part of the process in connection with vitrified grinding wheel manufacture is the burning of the wheels, in order to partially melt the bond and form a solid but porous wheel. Much skill and care is required to burn wheels successfully, as the temperature must be very accurately controlled for long periods. Vitrified wheels are extensively used for cylindrical grinding, for surface grinding when a disk form of wheel is used, for internal grinding, cutter grinding, and for many other purposes. They can readily be distinguished from other wheels by the reddish or reddish-brown color and the clear ringing sound produced when they are tapped.

PLATINOID

Platinoid is an alloy containing 60 per cent of copper, 14 per cent of nickel, 24 per cent of zinc, and 2 per cent of tungsten. The name is derived from the fact that it possesses some of the properties of a platinum alloy.

MESSENGER STRAND

A messenger wire or strand is a wire or cable strung along with and supporting wires, cables, or other conductors for electric current. A seven-wire galvanized strand is used for supporting lead-covered telephone cables. The heavy lead-encased telephone wire cables are not, in themselves, sufficiently strong to withstand the strain incidental to stringing those cables between poles a considerable distance apart. A wire rope of 5/16, 3/8, or 7/16 inch diameter, known as "messenger strand," is, therefore, strung between the poles, and the heavy telephone cable is suspended from this by means of clips, wire, or cord at short intervals.

TRANSIT

The transit is an instrument used in surveying for measuring both horizontal and vertical angles, although for ordinary work the vertical attachment is omitted. This instrument consists of a telescope mounted in standards which are attached to a horizontal plate called the "limb." Inside of the limb, and concentric with it, is another plate called the "vernier plate." The lower plate, or limb, turns on a vertical spindle or axis which fits into a socket in the tripod head. By means of a clamp and tangent screw, it may be clamped fast in any position, and made to move slowly through a small arc. The circumference of this plate is usually graduated in divisions of either one-half or one-third of a degree, and in the common form of transit these divisions are numbered from some one point on the limb in both directions around to the opposite point which will be 180 degrees. The graduation is generally concealed beneath the plate above it, except at the verniers. This upper plate is the vernier plate, which turns on a spindle fitted into a socket in the lower plate. It is also provided with a clamp by means of which it can be held in any position, and with a tangent screw by which it can be turned through a small arc. The transit generally is provided with a compass, so that the bearing of any given line with the magnetic meridian may be determined, if desired. It also has a spirit level attached to the telescope, so that it may be brought to a horizontal position and made to serve as a level.

GAGGERS

In molding, if a body of sand that must be lifted away with the cope extends below the parting, it is strengthened by the use of gaggers. These are usually L-shaped pieces of cast or bar iron. The upper part of the gagger, when rammed tightly between the cope bars, helps to support a hanging body of sand.

QUARTERING MACHINE

Quartering machines are used for boring the crankpin holes in locomotive driving wheels. As is generally known, the crankpins in a pair of driving wheels are located 90 degrees apart; hence the name "quartering machine." It is important to have these pins accurately located, because, if the various pairs of driving wheels are not accurately quartered, with the crankpins at exactly the same radius, they will cramp and bind in the rod brasses until these are either distorted or worn sufficiently to allow for the inaccuracy. Where comparatively small numbers of crankpin holes have to be bored, driving-wheel lathes are sometimes used which have quartering attachments. An attachment of this kind consists of a boring-bar mounted on the head of the lathe back of the faceplate. When the attachment is to be used, the bar is inserted through an opening in the faceplate so that the crankpin hole can be bored while the wheels are held between the lathe centers. These attachments are made in both single and double forms. With the double type, there is a bar on each head of the wheel lathe so that both crankpin holes can be bored simultaneously. These auxiliary boring-bars are adjustable with reference to the axis of the driving wheels, thus permitting them to be set in accordance with the throw of the crankpin.

ODONTOGRAPH

An odontograph, in the limited sense of the word, is an instrument for laying out the forms of gear teeth, or a guide used in cutting gears to a given form in a gear-cutting machine. The term is, however, also applied to any method or table for laying out gear teeth by means of circular arcs which closely approximate the exact tooth curves. The most generally known, as well as the most accurate, of these odontographs is the one devised by George B. Grant. This odontograph consists of diagrams and tables giving the radii and location of the centers for arcs that approximate the true gear-tooth shape.

SUCTION

Pumps for liquids, if located at some point above the source of supply, perform two separate operations when in use; first the water or other liquid is made to flow into the pump cylinder through a "suction pipe," and then it is forced out of the cylinder through a discharge or delivery pipe leading to any desired point. The flow of the water up to the cylinder is caused by a partial vacuum within the cylinder produced by the action either of a reciprocating piston or a rotating wheel or rotor, depending upon the type of pump. This vertical movement of the water in the pipe, or lift, is due to the fact that the atmospheric pressure on the surface of the water at the source of supply is no longer counteracted by an equal pressure inside the pipe; consequently, the water is forced upward and this is commonly referred to as "suction." The suction pipe should be free from air leaks, because a very small leak will affect the operation of the pump, especially if the lift is quite high. It is advisable to test the suction line with a pressure of at least 25 pounds per square inch.

METALLOGRAPHY

The science or study of the microstructure of metal is known by most metallurgists as "metallography." The name "crystallography" is also used to some extent. The examination of metals and metal alloys by the aid of the microscope has become one of the most effective methods of studying their properties, and it is also a valuable means of controlling the quality of manufactured metallic articles and of testing the finished product. In preparing the specimen to be examined, a flat surface is first formed by filing or grinding, and this surface is then given a high polish, which is later subjected to the action of a suitable acid or etching reagent, in order to reveal clearly the internal structure of the metal when the specimen is examined under the microscope. This process shows clearly to an experienced observer the effect of variation in composition, heat-treatment, etc., and in many cases it has proved a correct means of determining certain properties of industrial products that a chemical analysis has failed to reveal.

OHM

The unit of resistance to the flow of an electric current is known as an "ohm," and is equal to the resistance offered to an unvarying electrical current by a column of mercury having a mass of 14.452 grams (223.02 grains) at 32 degrees F., the column to be of constant cross-sectional area and to have a length of 106.3 centimeters (41.850 inches).

CUPOLAS AND AIR FURNACES

Two kinds of furnaces are used for melting iron preparatory to making castings, namely, cupola furnaces or "cupolas," as they are commonly called, and reverberatory or air furnaces. The cupola furnace is the most common, and is more simple in operation. In this kind of furnace, the iron and the fuel are charged together, while, in the air furnace, they are charged in separate compartments. The latter type of furnace is more frequently used in the making of malleable-iron castings. The cupola type of furnace is used in nearly all cases except when it is necessary to melt large bodies of iron, or when very large castings are to be made; the reverberatory type is preferable in the latter case, because a large body of metal can be obtained at one tapping. Ordinarily, some flux, such as limestone, is placed in the cupola when charging. This flux melts and serves the double function of first forming a slag by the combination of the lime with the silica from the charge, thus removing the silica, and also forming a protective covering for the bath of molten metal in the well of the cupola. In determining upon the various mixtures for producing different kinds of iron in a cupola, it is necessary to consider the quality and quantity of pig iron and scrap iron of various kinds, as well as the fuel and the flux that may be used.

FLASHING POINT OF OILS

The flash or flashing point of an oil is the temperature at which the amount of vapor given off is sufficient to form an inflammable mixture with the air over the surface of the oil, so that the gaseous mixture ignites and burns with a momentary flash when a flame is applied. If the temperature of the oil is increased, more vapor is given off, and, when the production of vapor is rapid enough to maintain a continuous flame, the temperature at which this occurs is called the fire test, firing point, or burning point of the oil. The flashing points of mineral lubricating oils vary, with few exceptions, from 300 to 600 degrees F. The flashing point can be considerably exceeded if the oil is protected by steam.

FIXED OILS AND FATS

Fixed oils are so named because they are not volatile without decomposition. They are obtained from the seeds or fruits of plants and the tissues of animals. All fixed oils become fats at low temperatures and, inversely, all fats become oils at 150 degrees F. The most common lubricants among animal oils are tallow, lard, neat's foot and sperm oil, and among vegetable oils, olive, rape, and castor oil. Ordinarily, animal oils are either colorless or yellow, whereas vegetable oils have various shades of yellow and green. The specific gravity of fixed oils varies from about 0.879 to 0.968 at 60 degrees F. Sperm oil has the lowest viscosity and castor oil the highest.

SILVER

Silver is the most malleable and ductile of all metals, with the exception of gold. Its specific gravity varies from 10.51 to 10.62. The average value is 10.53, making the weight per cubic inch 0.38 pound. Silver melts at a temperature of 961 degrees C. (1762 degrees F.). Its specific heat is about 0.056. Its coefficient of linear expansion per unit length, per degree F., equals 0.0000108. Its thermal conductivity is higher than that of any other metal, and is generally taken as the standard with which the heat conductivity of other materials is compared, that of silver being assumed as 100. As compared with copper, its heat conductivity is in the ratio of 100 to 74, and as compared with gold, in the ratio of 100 to 54. Silver is also the most perfect conductor of electricity, and is assumed as the standard with which all other conductors are compared, the conductivity of silver being assumed as 100. As compared with copper, its conductivity for electricity is in the ratio of 100 to 75, and as compared with gold, 100 to 73. In hardness, silver is superior to gold, but it is not as hard as copper. Fifteen grains of silver have been drawn into a wire nearly 600 feet long, and silver leaves have been beaten out to a thickness of only 0.00001 inch.

POISSON'S RATIO

If a square bar is stressed in a testing machine in the direction of its length, so that the length increases, there is a contraction in each opposite direction, which produces a decrease in the thickness of the bar. The ratio between the contraction at right angles to a stress and the direct extension is called Poisson's ratio. For ordinary kinds of steel this has a value of about 0.3. If the direct stress is a compressive stress, so as to cause decrease of length in the direction of the stress, then there will be an expansion in each direction at right angles equal to 0.3 times the compression.

MANOMETER

The manometer is an instrument for measuring the pressures exerted by gases or vapors; hence, the manometer is simply a pressure gage, although the term "pressure gage" is generally restricted to that type of manometer which is used in connection with steam boilers, air tanks, etc. The principle of the simplest form of manometer is based upon that law of hydrostatics according to which a liquid contained in a U-tube will show the surfaces at the same height in both vertical legs, if the pressures on the surfaces of the liquid in both are equal; but, if the pressure in one leg is greater than that in the other, the surfaces will be at different heights, the difference being proportional to the difference in pressure, and inversely proportional to the specific gravity of the liquid.

What MACHINERY'S Readers Think

on Subjects of General Interest in the Mechanical Field

THE DANGER OF LOWER PRICES

We all recognize the danger of too high prices and their effect on industry in case they become so high as to stimulate inflation and over-production on the one hand, and prevent normal industrial developments because of excessive costs, on the other; but has anyone thought of the danger of too low prices? Is there not a tendency on the part of large buyers to force down prices of the materials, machines, and tools that they buy to such a point that the manufacturer of these materials and tools is unable to get a reasonable return on his investment and to pay labor a satisfactory wage?

Take the automobile industry, for example. In buying machinery, small tools and materials, this industry makes every effort to obtain what it buys at the lowest possible price, often dictating the price. What effect does that have on the business of the automobile manufacturer, whose main interest after all, is to sell cars in a market where the purchasing power is strong? When efforts are made to press down prices unduly in the industries that furnish supplies and tools to the automobile industry, the effect is to reduce the purchasing power for the very product built by the automobile manufacturer. In view of the high selling costs in the automobile industry, would it not be more rational to try to make some of the savings deemed necessary on the selling end, rather than in holding down prices on tools and supplies to such a level that manufacturers of such supplies may find it difficult to pay good wages to their employes and a reasonable return on the capital invested. When able to do so, every progressive manufacturer wants to pay his employes the best wages possible, and that is true whether the manufacturer is engaged in the building of automobiles, machines, or tools, or in producing raw materials. It goes without saying that if good wages are paid in every industry, there are more customers for automobiles. G. A. Y.

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COST OF "HOMEMADE" EQUIPMENT

There are occasional firms who, when they need a metal-working machine for performing a given operation, believe it is more economical to build the machine themselves than to purchase one of several standard machines on the market which would be equally satisfactory from the standpoint of service. Recently a large company invested $30,000 in designing and constructing a machine that could be bought in the market for about $17,000. Not only was there this large difference in cost, but the machine did not work as satisfactorily as the regular machine, due to the fact that a simple but important principle had been overlooked in developing the design.

When a concern manufactures a line of standard machines, the cost of designing the machines and making the patterns is distributed over a large number of machines, whereas when only one or a few machines are built, this cost becomes much higher per machine. Therefore, when a machine is built to do work for which a standard machine could be bought, the expenses for designing and pattern-making are usually greater, by a substantial amount, than the profit that the builder of the standard machine receives on the sale of one of his machines. Much time is also consumed in designing the special machine, and the chances are that it will not function as efficiently as the equipment already on the market. Generally, therefore, it is false economy to build a machine specially for a job if a suitable machine can be purchased on the market. N. R. M.

THE SCARCITY OF SKILLED MECHANICS

I have read with considerable interest what Mr. Wheeler has to say in March MACHINERY about the scarcity of skilled workers. Considering the average conditions, I fail to see that there is any shortage of skilled mechanics. During the war, we were able to enlist in the mechanical industries a sufficient number of skilled men to carry on a production that has never been equaled before or since. There certainly was no scarcity of skilled men in 1921 and 1922. First-class toolmakers and machinists at that time were unable to obtain employment in the trade in which they were experienced; there were many who considered themselves fortunate if at that time they could obtain a job washing dishes in a lunch-room.

Since that time, conditions have gradually improved, but even today there are a great many skilled toolmakers and machinists who find it to their advantage to make their living in some other occupation. Furthermore, because some shops have difficulty in keeping good men after they get them, this must not be construed as a sign that good men are scarce. They are not scarce, but some of them have been scared into other lines of business. This fact seems to be generally ignored in most of the discussions on this subject. This, I believe, is the important fact that should be pondered upon.

A reasonable assurance of steady employment is one of the most important things in attracting a good man to a job. I do not believe that there is any scarcity of skilled men for steady work.

It should also be borne in mind that a good machinist and toolmaker is a man of considerable training and intelligence who can quickly adapt himself to many other pursuits that call for a high degree of skill, outside of his chosen vocation. I could write down the names of dozens of men whom I know, personally, to be good machinists and toolmakers, but who are now following other lines of employment.

Isn't the crux of the whole matter, after all, the fact that the economic status of the machine-building industry is such that it is unable to attract and hold men of the greatest ability and skill. The general industries of the country as a whole have moved forward by leaps and bounds, and through the use of efficient methods, on the one hand, and effective economic management, on the other, have placed themselves in a position so that they are able to attract the best men away from the machine industry. What we need is that this industry be placed on the same economic basis as the fields that are attracting men away from it. Then we will again have a balanced economic state of affairs, and the best men will again be attracted to the machine shop. OBSERVER

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STANDARDIZATION OF BOOK SIZES

I have often wondered why there is such a lack of standardization of book sizes, especially in technical publications. Why doesn't some society formulate a set of standard dimensions for technical books? These could be so selected that from three to five sizes would meet all requirements. A man who is collecting a library and wants to have it look attractive doesn't like the conglomeration of sizes put out by the publishers at present, and I know in my own case I have passed up good books because the sizes did not fit in with the other books in my library. I believe standardization is always valuable, even in book dimensions.

WILLIAM C. BETZ

POLISHING SCISSORS AND SURGICAL INSTRUMENTS

The various parts illustrated in Fig. 2 require the highest quality of workmanship in finishing. Considering first the surgical scissors, which are usually plated, the loops are first polished by means of straps made of cotton webbing, which are about 1/2 inch wide. The operations are roughing, dry-fining, greasing, and coloring. By polishing the inside of the loops first, the finishing of the straight blade of the scissor permits the removal of any grooves or ridges that may have been produced in polishing the loops.

Compress canvas wheels of medium grade density are used for the other surfaces, the working speed being 7000 feet per minute. The scissors are steel forgings, and have no pre-

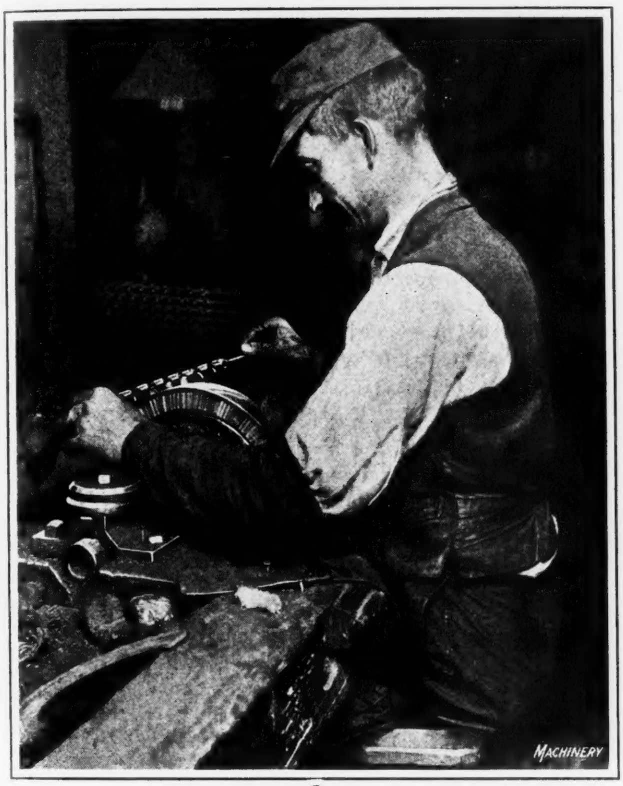

Fig. 1. Use of Compress Wheel for polishing Augers

vious finish when applied to the polishing wheels. The faces of the wheels are stoned with pumice after the heads have been prepared by applying two coats of emery by the rolling process. For roughing small work, No. 150 Turkish emery is used, and for large work, No. 120. This first operation is intended merely to remove all burrs and prepare the work for the dry-fining operation which follows. The dry-fining operation is used only for large classes of work, the second operation on small work being greasing. For dry-fining, No. 180 or No. 200 emery is used, the compress canvas wheel being greased with wax. A medium density wheel is used for the curved surfaces, and a hard density wheel for maintaining the corners on the blades.

Two operations are sometimes necessary for greasing small work. For rough-greasing, No. 120 emery is used on the face of a medium density compress canvas wheel, and for finish-greasing, No. 200 emery is used. The density of the wheel used, it is well to note, may be varied as the shape of the work requires. The composition of the cut cake used on the greased wheel consists of tallow and beeswax, to which sufficient emery of the same grain size as that used on the wheel face

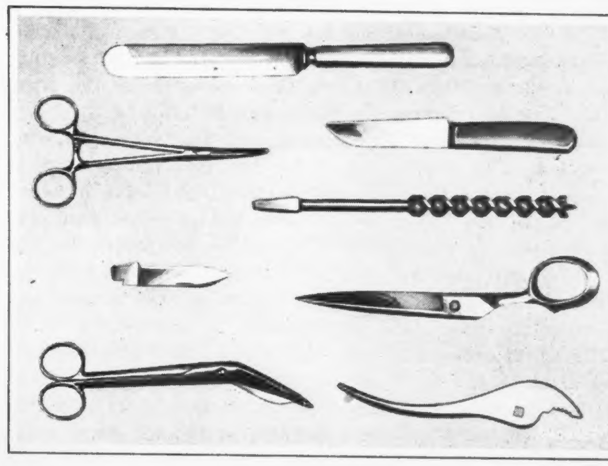

Fig. 2. Cutlery and Other Articles which are highly polished

is added. Scissors and surgical instruments are then colored on a soft leather wheel, which carries a coating of FF emery. This wheel is carefully stoned and treated to applications of charcoal during coloring.

The cheaper grade of scissors, which are of malleable iron with welded steel edges, are simply roughed, greased, and colored, using medium density wheels for the blades and soft wheels for the necks. The loops are finished by the use of straps in the manner already mentioned.

The application of formed wheels for finishing the shanks of scissors and surgical instrument blades is shown diagrammatically at *A* and *B*, Fig. 3. Both of these wheels are made of compress canvas, having a 2-inch cushion of medium density. It will be noted that the arrangement shown at *A* provides for finishing scissors on a double-header polishing machine. At the right and in the lower part of the illustration are shown the shape of formed face wheels suitable for polishing around and under the loops of scissors.

Scissors and surgical instruments of the higher quality are usually plated, and then buffed with 64 by 68 count muslin buffs, operating at a surface speed of from 7500 to 11,000 feet per minute. The buffing wheels are treated with "White Diamond," "Acme White" or any other suitable polishing composition.

Finishing Pliers and Grooves of Augers and Drills

Pliers made of forged steel, unplated, are given a high luster with flat-face wheels. A wheel of medium soft density is used for the edges so that the wheel will cover the curved

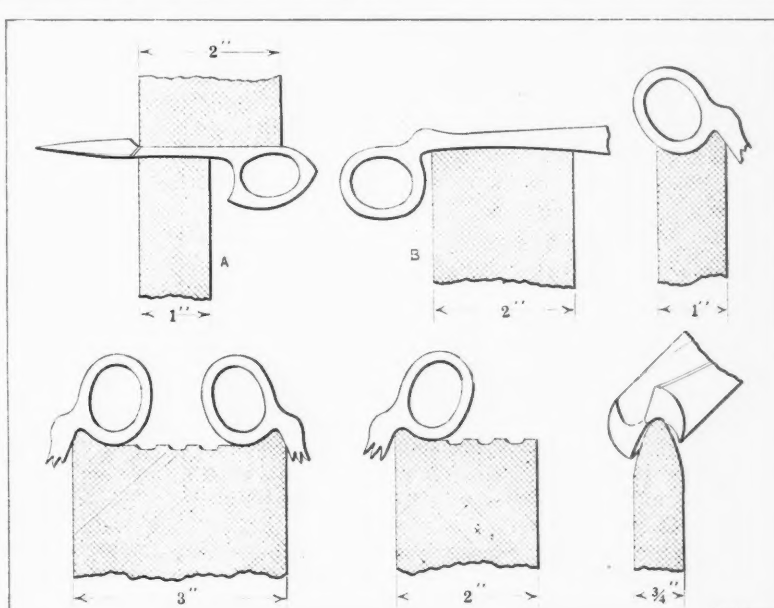

Fig. 3. Diagrammatic Illustration of the Shapes of Polishing Wheels Suitable for finishing Scissors and the Helical Grooves of Drills and Augers

surface, and a medium density wheel is used for the sides of the pliers. Four operations are required for each of the flat surfaces and for the narrow curved surfaces at the front and back of the forgings. The roughing operation on the edges of the forging removes the flash, and is followed by a dry-fining operation, then by greasing, and finally by a coloring operation. The wheels are of the compress canvas type, 14 inches in diameter, 2 1/2 inches wide, and have a 2-inch depth of cushion. They are prepared with a rolled head, and the abrasives used are No. 46 alundum for roughing; No. 120, for dry-fining; and No. 150, for both greasing and coloring. For the coloring operation, crocus coloring cake is used and the wheel is stoned, and soft charcoal is applied.

The spiral grooves of twist drills and auger bits are handled in much the same manner as chisels and other highly polished builders' hardware. Attention should be called to the shape of the wheel used in finishing the spirals of twist drills, which is indicated in the lower right-hand corner of Fig. 3. These wheels are made of compress leather, extra hard density, and have a 2-inch depth of cushion. Wheels for this kind of service are usually made about 12 inches in diameter and 3/4 inch wide.

Extensive use is also made of polishing wheels for finishing all surfaces of twist drills and auger bits. In Fig. 1 the operation of polishing the exterior of an auger bit with a compress leather wheel is shown. In general, it may be added that the various grades of bits and twist drills and the methods of manufacture greatly affect the polishing procedure. Sometimes only two operations are required, but more often four are necessary to produce a high quality of finish. The grading of abrasives for the latter class of work would be Nos. 80, 120, 150, and 180 or 200.

* * *

UNAUTHORIZED USE OF MANUFACTURERS' DRAWINGS

In an article in *Mechanical Engineering*, W. W. Nichols, assistant to the president of the Allis-Chalmers Mfg. Co., points out that manufacturers are confronted more and more with the problem of purchases demanding complete detail working drawings, not only in cases where contracts are awarded but in connection with preliminary bids. The request for these drawings usually, so purchasing agents claim, are due to the insistence of the engineers in the customer's plant. In outlining his ideas on this subject, Mr. Nichols proceeds as follows:

Machinery builders cannot and do not object to furnishing drawings necessary for the care and operation of their machines. But demands for full sets of detail drawings invite, and in fact have led to, grave abuses. While simpler parts may be readily duplicated, many machines have important features requiring special material or treatment only safely supplied by the original builder or one equally "skilled in the art." Herein lies the danger of drawings falling into the possession of less experienced shops whose faulty construction, guided perhaps by inaccurately copied drawings, is detrimental both to the efficiency of the machine and the reputation of its original designer. Failure to recognize this has resulted in costly experiments and a belated knowledge that even the owner's interests can be served by the responsible builder better than by any less concerned substitute. Drawings are copied in spite of injunctions to the contrary. They have been appropriated by the purchaser's employes and made public property. Engineers have been known to take drawings of several manufacturers to make a composite, and thereby acquire unfairly and without cost the results of years of high-priced work. Even our Government insists on drawings, which are subsequently used in advertising for bids on repair parts.

An important part of a manufacturer's assets is his accumulated engineering experience, which may cover years of time and millions of dollars. This is embodied in the machinery supplied the purchaser, who thus obtains the full benefit of it, but this does not justify his demanding that which, when divulged, robs the manufacturer of what may be his most important asset. Therefore, if he be responsible, is it an ethical proceeding for the engineer to be a party to this "pirating" of designs, especially when broadcast for the benefit of those who have borne no part of the cost of their development?

Furthermore, an economic waste ensues which has to be absorbed. Regularly furnishing engineering service without any compensation whatever would compel the manufacturer's ultimate retirement from business. Any waste in engineering expense is visited sooner or later on those responsible for it. The purchasing agent who, in obedience to the behest of his engineer, stipulates any course that leads to an unwarranted expense, sooner or later adds to the cost of the commodity undergoing negotiation. The unsuccessful bidder must increase his overhead to compensate for any waste incurred, and apply this increase to his future bids or retire a bankrupt.

To repeat, investigation has proved that engineers are principally responsible for establishing the abuse, and an appeal is made to the profession to eliminate the practice, if for no other than purely ethical reasons. The American Society of Mechanical Engineers' Code of Ethics for Engineers provides the remedy if it be properly interpreted. Can violators of its tenets be safely called to account? If the code means anything potent for good, here is one situation that merits a painstaking, not superficial, analysis that will work toward the elevation of professional conduct.

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UNIFICATION OF WIRE AND SHEET-METAL GAGES PROPOSED

The American Engineering Standards Committee has been requested by the Society of Automotive Engineers to take up the unification of wire and sheet-metal gage systems in order to arrive at a national standard system of designating the diameters of metal wires and the thicknesses of metal sheets (as mentioned in March MACHINERY). The systems of gage numbers by which these products are generally designated at present have been developed and adopted in the course of time in different trades and for different products.

In the request submitted by the Society of Automotive Engineers, there are listed thirteen gage systems now in use in this country. For example, the "American wire gage," or "Brown & Sharpe gage," which is widely used for non-ferrous wires (copper, brass, aluminum), was devised in 1856 by the founders of the Brown & Sharpe Mfg. Co., and adopted by the Association of Brass Manufacturers in 1857. The name "American wire gage" is of a later date.

Steel wire, however, is indicated by various systems of gage numbers, which differ not only from the "American wire gage" system for copper wire, etc., but also from each other. Thus, according to present practice in this country, a copper wire No. 6, "American gage," has a diameter of 0.162 inch; a steel wire No. 6, "United States steel wire gage," has a diameter of 0.192 inch; while "Stub's steel wire" No. 6 has a diameter of 0.201 inch; and sheet steel according to the "United States standard gage" No. 6 has a thickness of 0.1992 inch. This wide diversity necessarily leads to confusion. Errors frequently occur in the filling of orders and in industrial work in general. Some organizations, in order to avoid confusion, have entirely done away with gage numbers and designate wire and sheet metal sizes exclusively in decimal fractions of an inch.

A question closely connected with the designation of wires and metal sheets is whether or not it is feasible to thin out the series of diameters or thicknesses actually listed in the catalogues of the different trades. Inasmuch as a procedure of this nature involves the element of "simplification," the American Engineering Standards Committee and the Division of Simplified Practice of the Department of Commerce have made arrangements to cooperate actively in this matter. The latter body will undertake to bring about production surveys in the trades concerned, in order to find out the relative importance of wires and sheets made to the several gage numbers.

Methods of Securing Posts and Tubes

By H. M.

THE fastening of posts and tubes to plates, bars, or castings is an everyday job for the machinist and toolmaker. Various methods of attaching such parts are in common use, and most of these are used under certain conditions. However, unless the machinist is familiar with a number of fastening means, he will not always employ the most efficient one for a given job. In the accompanying illustrations are shown quite a number of securing methods that have proved practical, and these will be described in the following.

At *A*, Fig. 1, is illustrated a plain post having the lower end turned down and driven through a hole in the plate, which is shown in cross-section. After the post has been driven into place, the end is upset by hammering to hold it securely. At *B* is shown a similar construction, with the exception that the end of the post is spot-drilled to make it easy to upset by hammering or riveting in a machine. Examples *C* and *D* are also shouldered posts, the example at *C* consisting of a post riveted into a hole in which there are four vee indentations that prevent the post from turning. In example *D*, the post has a round shank which is riveted into a hexagonal hole in the plate to prevent it from revolving.

Posts held in plates by means of screws are illustrated at *E* and *F*. In example *E* a plain fillister-head screw is used, which extends through a hole in the plate and into the end of the post, the latter merely butting against the plate. In example *F*, the post enters a hole in the plate, and is prevented from being drawn out by the screw-head. The head is larger than standard. At *G* is shown a familiar construction in which the post simply has a head on the lower end that seats in a counterbore on the bottom side of the plate to prevent the post from being drawn through the plate.

Construction *H* is particularly good for attaching a post to a very thin plate. This post has a thread on which a thin nut is placed on each side of the plate. When these nuts are tightened on the plate, the post is clamped securely. A post screwed into the plate itself is shown at *I*. Example *J* has a shoulder between the head and the post proper, and on this shoulder there are either straight or spiral serrations which prevent the post from turning after the shouldered portion has been driven into the plate hole. Two methods of pinning a post in place are illustrated at *K* and *L*, in the former a taper pin being driven through the center of the post, while in the latter a straight pin is driven through the plate and post in such a manner that the center of the pin is tangent to the periphery of the post.

Posts Free to Revolve

All the preceding fastening methods are suitable for securing a post in place permanently, but it is often necessary to fasten a post in such a way that it can revolve. Constructions of this class are illustrated in Fig. 2. At *A* is shown a post with a head beneath the plate and a washer held against the top of the plate by means of a cotter-pin. The fit of the post in the plate hole is sufficiently loose to permit it to revolve, while the shoulder of the head and the washer hold the post from coming out. In example *B*, the post is pinned in a bushing which has a head on the lower side of the plate and a thread on the end projecting above the plate. A collar or nut is screwed on this thread against the shoulder of the bushing, the shoulder extending a small amount above the plate. This nut holds the bushing in place. The post is pinned to the bushing before the bushing is put into the plate. Check-nuts are often used in designs of this type, particularly if the bushing is tapered to permit adjustment.

The example at *C* is a simple mounting in which a pin is driven through the plate and through a groove turned around the lower end of the post. This construction anchors the post in the plate and yet permits it to revolve freely. At *D* the post has a tapered end that is free to revolve in a corresponding hole in the plate, the taper preventing the post from being pulled up through the hole. The taper portion may be swaged or turned to shape, and should be fairly steep. If the post did not need to rotate, the taper could be slight and the post driven tightly in place. When the post of a rotary construction of this kind must be prevented from being pushed back through the plate, a thin plate may be

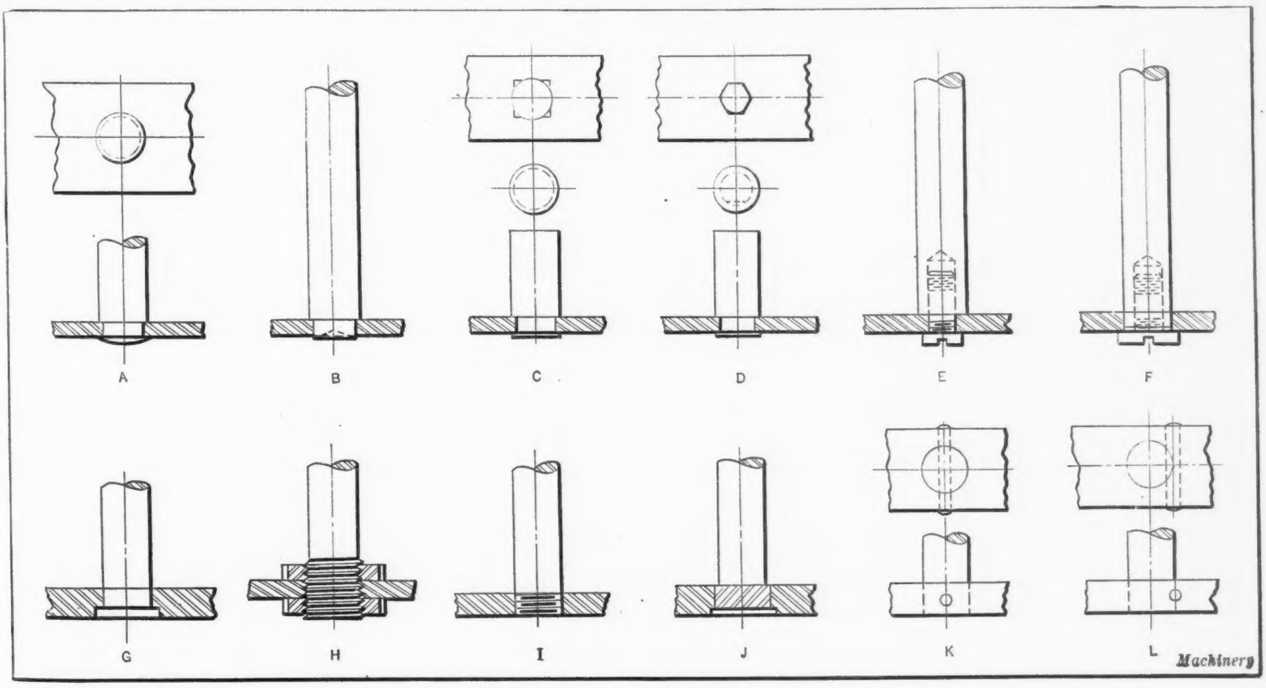


Fig. 1. Methods of fastening Posts in Parts so that they cannot Move

attached under the post, as shown at *E*. The thin plate may be secured in place by the use of screws.

The example shown at *F* permits the post to have a limited float for self-aligning at slight angles. The end of this post is turned to a ball shape and secured between two plates bored to receive it. The plates are pinned together after the head is in place. It will be noted that this post cannot be pulled up or pushed down and that it is free to swing in any direction for aligning purposes.

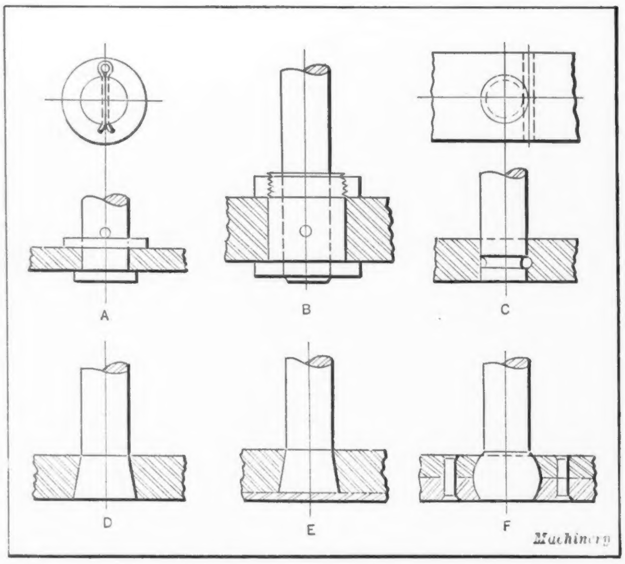


Fig. 2. Constructions in which the Posts are Free to revolve about their Axes

Tubular Post Mountings

The use of tubing for posts necessitates a variety of anchoring constructions, a number of which are shown in Fig. 3. At *A* is illustrated a very secure mounting; the tube has an inner shoulder swaged on it that contacts with the plate on the upper side, and when the tube has been driven into the plate from the top, the lower end is swaged over. With this construction the post cannot be moved in either direction. In example *B*, the lower end of the tube is swaged into a countersunk hole and cannot be pulled up through the plate. A somewhat similar construction is illustrated at *C*, the tube being swaged at the lower end into a ball shape that allows the end to float in a corresponding hole, so that the tube may be placed into alignment with a co-acting part.

An unusual construction employed for securing a tube in a bar of steel is shown at *D*. This tube has a series of grooves swaged on the end that is to be anchored. After this end has been forced into the bar, a pin is driven into the end of the tube to force out the metal of the grooves and thus securely anchor the tube in the plate.

In the construction illustrated at *E*, two holes are pierced in a thin plate and prongs on the end of the post are extended through these holes and bent over. The shoulder formed by the portion of the post end between the prongs, in conjunction with the bent-over portion of the prongs beneath the plate, produces a firm anchorage. In the construction shown at *F*, the prongs are sheared out of the sides of the post and form upper shoulders, while the lower end is swaged out into a countersunk hole to keep the post from being drawn up. In the final example, illustrated at *G*, two small slots are pierced through the plate on opposite sides of the hole, and the tube is swaged out so that the projections enter these slots and prevent the tube from turning. The end of this post is also swaged into a countersunk hole so that it cannot be pulled up through the plate.

The relative merits of the various constructions described have not been discussed, since the examples are intended merely to be suggestive. Some of them are adaptable only to jobs carried out on a quantity basis.

* * *

BRAZIL AS A MARKET FOR MACHINERY

In referring to Brazil as a market for industrial machinery, M. A. Cremer, assistant trade commissioner at Rio de Janeiro, calls attention to the fact that the low cost of labor in Brazil retards the use of machinery in some instances, although this situation is changing in the central coast states where labor costs are increasing and help is getting scarcer. The lack of training in the handling of machinery tends to discourage the use of the most modern types of equipment and often the fine points of up-to-date machinery are not appreciated. Proper care is seldom given to equipment, and machinery that will stand a great amount of abuse and lack of attention is preferable. There are, generally speaking, but few good mechanics in Brazil.

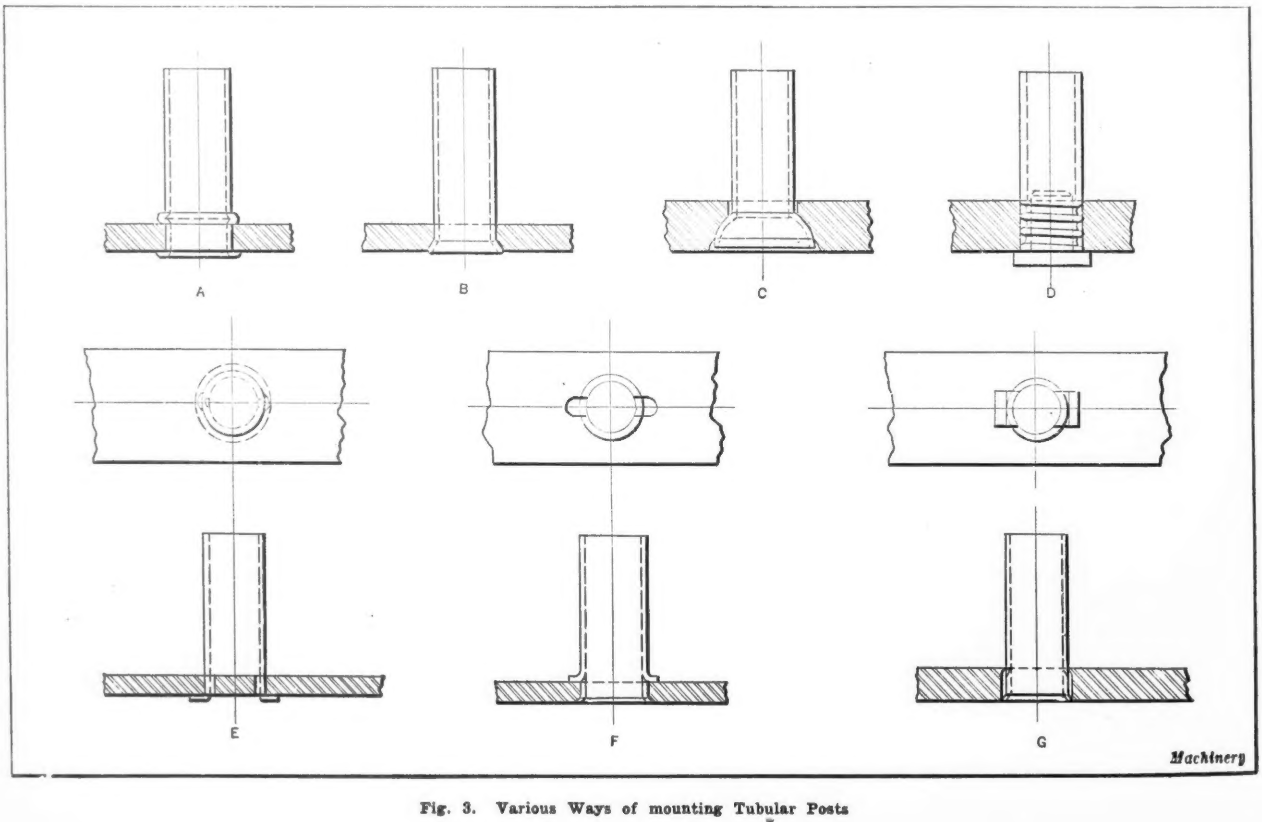
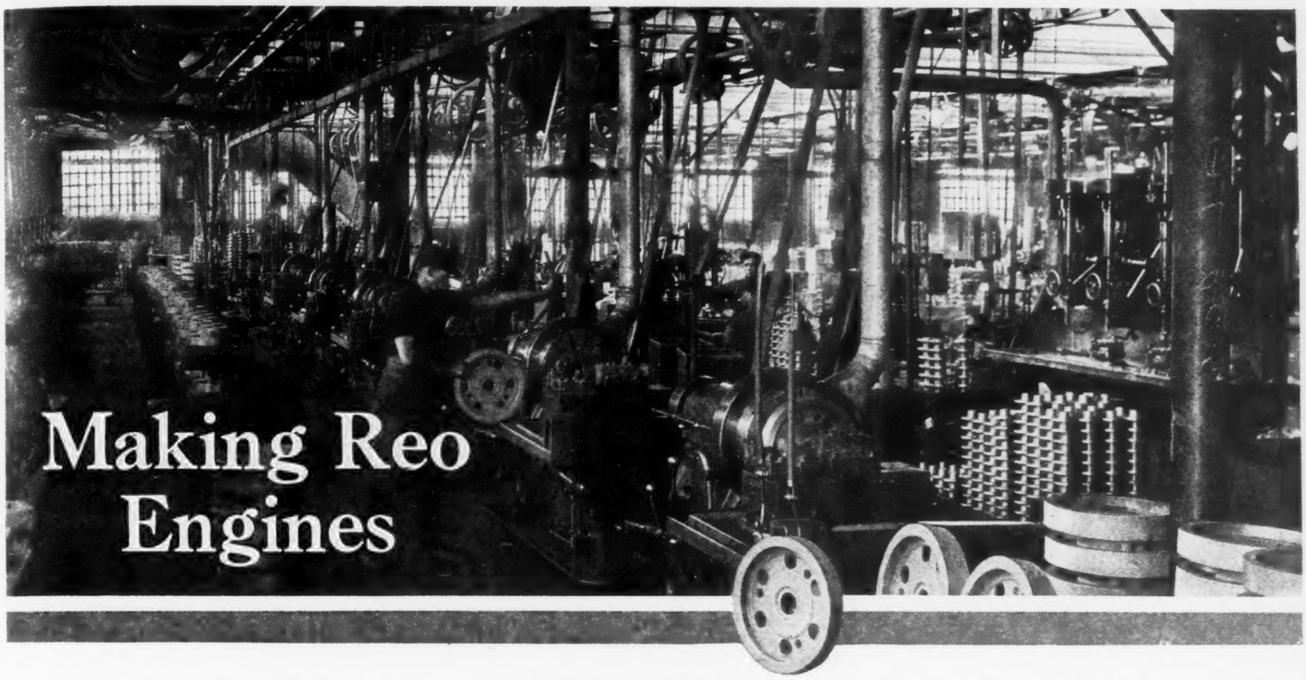


Fig. 3. Various Ways of mounting Tubular Posts



Making Reo Engines

Operations Selected from the Flywheel, Camshaft, Connecting-rod, and Cylinder Lines of Manufacture

EFFICIENCY has been attained in the engine department of the Reo Motor Car Co., Lansing, Mich., by arranging all lines of machines crosswise of the building to feed the engine assembly line which runs along one side of the building. The various lines of machines are so located that the different parts are delivered to the assembly line at exactly the points where they are needed for assembly into the engines. For instance, the cylinder blocks are finished by the first rows of machines in the department for feeding the assembly conveyor at the starting point. Rough forgings or castings trucked to the beginning of each line of machines are finished complete when they reach the opposite side of the shop. There are a number of interesting operations in this manufacturing department, some of which will be described in this article.

Turning, Facing, and Boring the Flywheel

Reo flywheels have a large integral hub or "bell" in which internal gear teeth are cut. Because of this design considerable thought was required in tooling up a new line of machines for taking the turning, facing, and boring cuts. These cuts are taken in the battery of six "Simplimatics" shown in the heading illustration, which are built by the Gisholt Machine Co. Two operators tend these six machines, and four separate operations are performed, two of the machines duplicating the work of the other two. The rough castings are stacked as shown in the foreground, and transferred to the successive machines by means of cables and hooks which are suspended from trolleys running on an overhead monorail. Each machine is provided with two tool-slides which are moved longitudinally or transversely as may be required.

In the first machine, the chuck jaws grip the hub or bell, the flywheel proper extending toward the tool-slides. All chucks on these machines are equipped with three jaws and are pneumatically operated. The periphery *A* and the inside of the rim *B*, as shown in Fig. 1, are rough-turned by two tools on the front slide, which is fed longitudinally for the step, while surfaces *C*, *D*, and *E* are faced simultaneously by three tools on the rear slide. This slide moves transversely in this operation.

The flywheel is then passed to the second machine, where it is accurately located in the chuck by seating face *E* against hardened pins, and gripping the rough-turned periphery *A*. Fig. 2 shows the tool set-up used in the second operation, which is performed by the second and third machines in the line. Three tools on the front slide face surfaces *F*, *G*, and *H*, Fig. 1, and cut groove *J* to furnish clearance when cutting the gear teeth in bore *L*. In this step, the front slide moves longitudinally to bring the tools to the different surfaces, and then is fed transversely for the facing operation. When the front slide has completed its movements, the rear slide is automatically brought into line, so that three tools mounted on it can turn inside surface *M* of the rim, bore hole *L*, and turn the hub at *N* for a width of 3/4 inch. When the flywheel is removed from this machine, it is completely rough-machined.

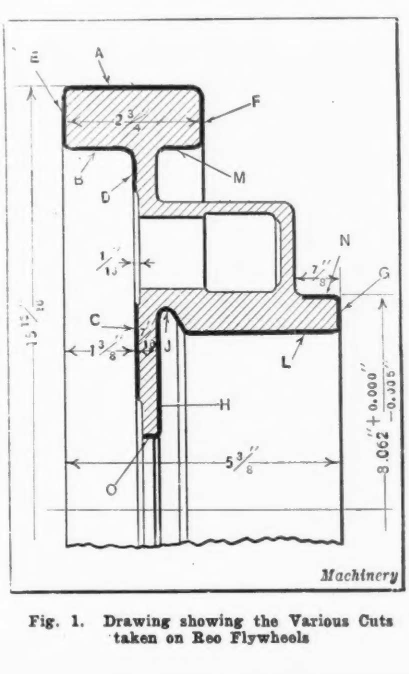


Fig. 1. Drawing showing the Various Cuts taken on Reo Flywheels

In the third operation, the work is mounted in the chuck the same as in the preceding one, and finishing cuts are taken on surfaces *G*, *L*, and *N* by tools substituted for the tools used in roughing these surfaces in the previous operation. In addition, a boring-bar is mounted in the position previously occupied by the tool that faced surface *H*, the boring-bar being provided with two cutters for rough- and finish-boring and chamfering hole *O*. This hole receives a finished shank on the flywheel hub when the hub is assembled. Two machines are also used for this finishing operation.

In the fourth and final operation performed in the "Simplimatics," hole *O* is

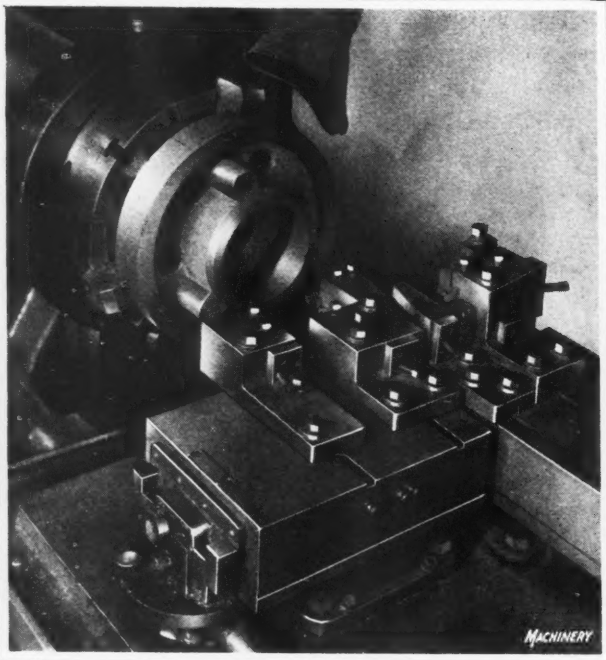


Fig. 2. Set-up used on a "Simplimatic" for the Second Operation of turning, boring, and facing the Flywheels

seated on a chuck spindle, and wall H is held against a locating surface of the chuck, so that all surfaces finished in this operation will be true with the flywheel hub when it is assembled. A C-washer attached to the chuck spindle pulls the work against its seat when the spindle is drawn back. On the front slide of this machine there are three tools; the first takes a second roughing cut on periphery A; the second, a finishing cut on the same surface and the third, a chamfering cut where surface B joins surface E. At the same time two tools on the rear slide are fed transversely to finish sides E and F of the rim. When the tools have been fed across the different faces, the machine speeds up for returning them. On the return, a very light finishing cut is taken on surface A.

Turning the Risers on the Camshafts

In the camshaft group of machines, the Gordon camshaft lathe shown in Figs. 4 and 5 is employed for turning the risers, which are afterward ground. The tools are arranged in back of the work, the work revolves clockwise, as viewed from the right-hand end, and the work feeds to the right past the cutters. Thirteen tools are used simultaneously, twelve for the risers and one for the pump eccentric at the right-hand end of the camshaft, as shown in Fig. 4. The work is held by a headstock and tailstock mounted on an auxiliary bed or platen, which is fed from right to left on the main bed of the machine by a lead-screw.

The means employed to control the tools in relation to the particular cam each one is turning constitute the most important feature of the machine. As each cam is revolved, there is a constantly varying distance between the center of the camshaft and the point at which the tool is applied, as well as a change in the angularity of the surface being machined. It is necessary to provide forward and backward movements to each tool to compensate for the first of these factors, and, in addition, to provide an up and down swinging movement so that a constant clearance angle can be maintained between the cutting edge of the tool and the surface being turned.

The necessary tool movements are produced by means of master cams arranged on a shaft at the rear of the machine, as shown in Fig. 5, the tools being mounted in holders which pivot on the large-diameter over-arm. Each holder swings backward and forward according to movements imparted by one master cam, while a second master cam imparts a partial revolution to the tool-holder at each revolution of the work, in order to maintain the clearance angle between the tool cutting edge and the work, as previously mentioned. It will be noticed that two flywheels are mounted on the shaft that carries the master cams.

Obviously, in this operation, it is necessary that each piece of work be placed identically in the machine. This is accomplished by fitting a reamed hole in the flange at one end of the camshaft over a pin in the headstock chuck. This hole is reamed in line with the center of one riser. The end of the camshaft at the headstock end is gripped on a finished bearing, while the tailstock end is held on a center. Two steadyrests are provided for the two middle bearings of the work, in order to insure steady rotation.

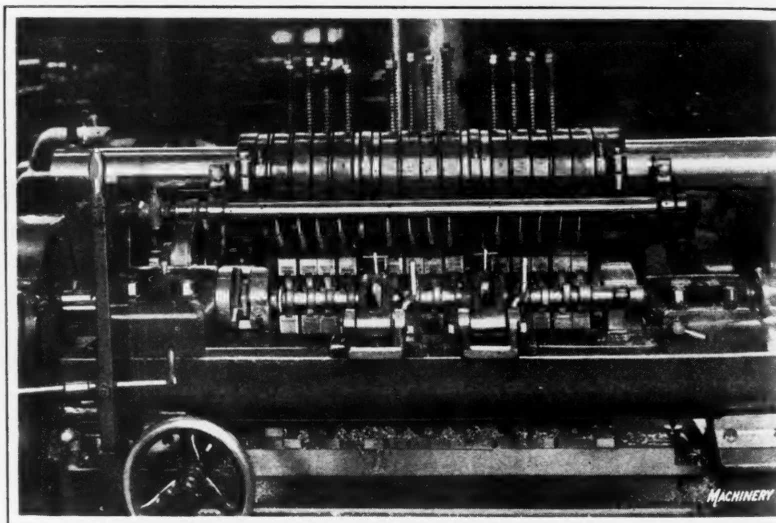


Fig. 4. Turning Twelve Cam Risers and the Pump Eccentric on the Camshafts

Balancing the Crankshafts

In the preliminary balancing of the crankshafts, static balance is approximately obtained by drilling a 1 1/2-inch hole in the center of the middle crankpins. The amount of metal to be drilled out is determined by means of the fixture shown in Fig. 3, which is used to find the forces in the two pairs of end cranks that tend to revolve the crankshaft when one of the pins of the central cranks is rested on scale beam A. After this force has been weighed for the two end cranks with the work in the position illustrated, the scale beam is pulled to the front of the fixture, and the crankshaft revolved to bring the same central crankpin forward again on the scale beam and to lower the cranks next to the end

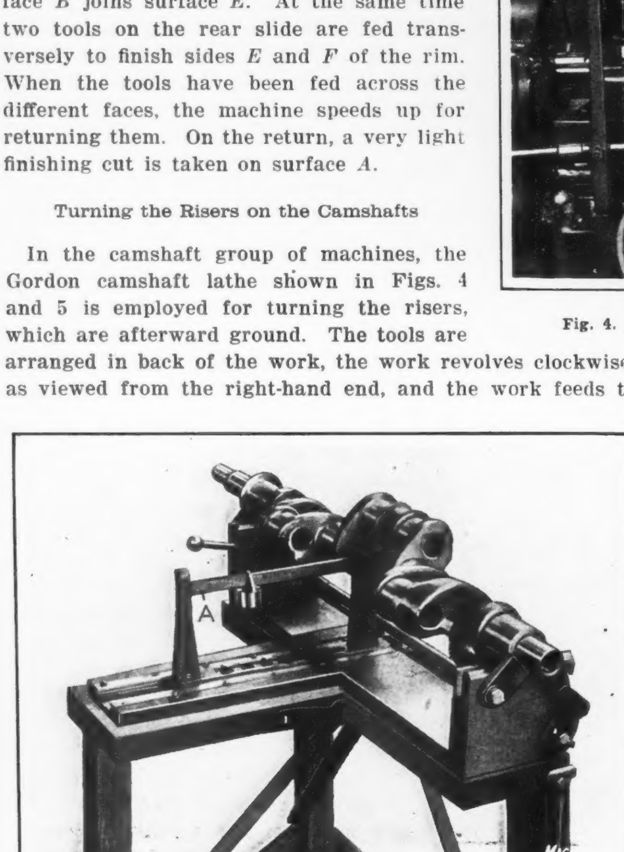


Fig. 3. Fixture used for determining approximately the Amount of Metal to remove from Crankshafts to produce Static Balance

ones. The forces in these second cranks can then be determined.

On one side the scale beam is graduated in inches, and the reading represents the depth to which the hole is to be drilled in the central crankpins to counteract the static unbalance. Different readings are obtained, of course, for the two pairs of cranks, and it is the custom simply to drill to suit the heaviest cranks. When the work is first placed in this fixture, the end bearings rest in vees, but before the weighing, the hand-lever at the left-hand end is operated to lower the vees, so that the crankshaft rests on hardened strips on the ends and on the scale beam at the middle.

Static and dynamic unbalance are then determined in two Olsen-Carwen balancing machines (one of which is shown in Fig. 7), and corrected by milling stock off the cranks in the vicinity of the crankpins. Both static and dynamic unbalance are determined when the work is rotated at the critical speed by turning the two handwheels on the headstock end to create an unbalance in the head that will equal the amount of unbalance in the work and be in the opposite angular plane. The amount of the unbalance in ounce-inches and the angle of the unbalance are read directly from the dials.

In determining static unbalance, one end of the bed rests solidly on the base, while the other oscillates up and down, but in the dynamic test, only the rear left-hand corner of the bed rests solidly, so that a wabble is produced in conjunction with the oscillation of the bed. The change in the suspension of the bed is accomplished by means of handle *A*, which operates a device installed on the machine at the Reo plant.

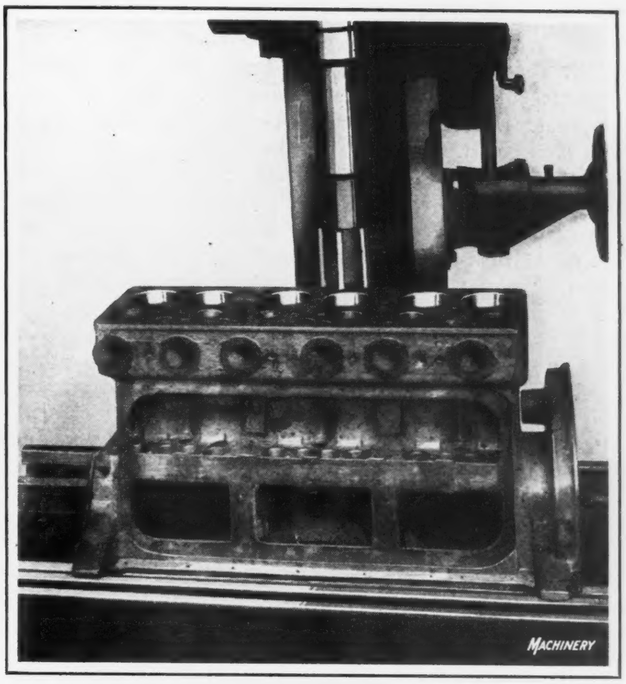


Fig. 6. Size-reaming Cylinder Bores under a Single-spindle Drill

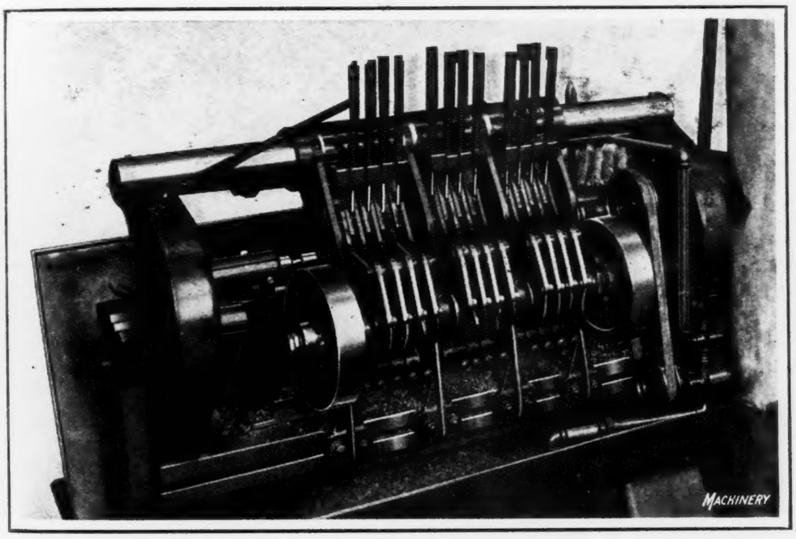


Fig. 5. Rear View of Camshaft Lathe, showing Swinging Tool-holders and Master Cams

The exact amount of metal to be removed from the work to compensate for the unbalance is determined from unit *B*, which also has been added to the machine by Reo engineers. In housing *B* is a large disk which is rotated by turning knob *C*, and on this disk there are several circular rows of numbers which tell how much metal must be removed. These numbers on the disk appear beneath the numbers 1, 2, 3, etc., placed above the horizontal portion of slot *D*. After the unbalance has been found in ounce-inches, the knob is turned until the number corresponding to that ounce-inch value appears at the left-hand of slot *D*. Then the crankshaft is turned until the machine shows the heavy portion to be directly above the center of the work. The distance from the center of the crankshaft to the outer edge of the crank-arms at this point is next measured by means of a scale, and if it happens to be 3 inches, for instance, the number on the disk beneath the number 3 of slot *D*, represents the amount of metal in ounces that must be removed to counteract the unbalance.

Size-reaming All Cylinder Bores with One Tool

In size-reaming the cylinder bores prior to grinding, all six bores are reamed with one tool to insure that they will be of the same diameter for the cylinder grinders. If six spindles were used for size-reaming all bores simultaneously, there might be small variations in their diameters, because of differences in the size of the reamers. Before this reaming operation, the bores are rough-bored, second rough-bored, and reamed in six-spindle machines. In the size-reaming, about 0.010 inch of stock is removed on the

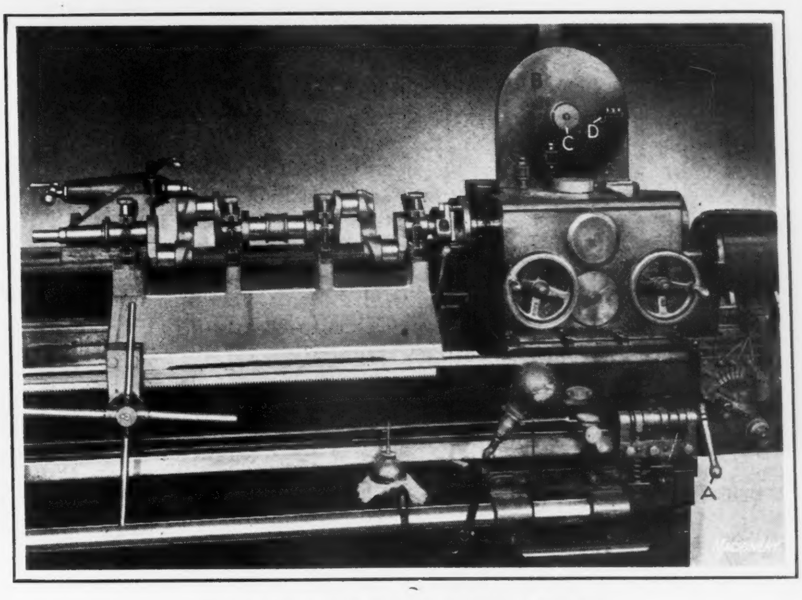


Fig. 7. Static and Dynamic Balancing Machine

diameter, and 0.006 inch of stock left for the grinding. The reamer is fed about 5/16 inch per revolution. For reaming the different bores, the work is simply slid longitudinally on hardened strips of the table seen in Fig. 6.

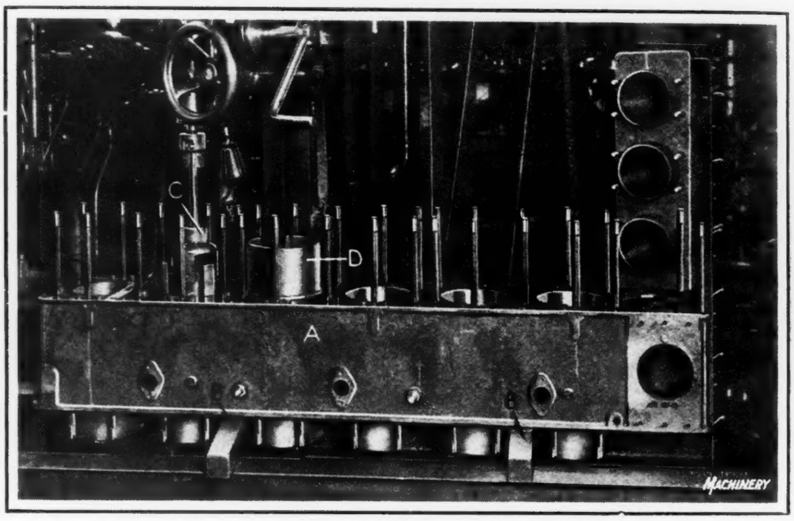
In rough-grinding the bores, from 0.004 to 0.005 inch of stock is removed, and then after cooling, from 0.001 to 0.002 inch of stock is removed in finishing. The limits on the diameter are plus or minus 0.001 inch, and on the straightness, 0.001 inch. The bores must not be out of round more than 0.0005 inch at the top nor more than 0.001 inch at the bottom.

* * *

LAPPING MOTOR-BOAT ENGINE CYLINDERS

The lapping method is used at the plant of the Sterling Engine Co., Buffalo, N. Y., to obtain a mirror-like finish in the cylinders of motor-boat engines. In the accompanying illustration, this operation is shown being performed on a six-cylinder unit made up by fitting six steel sleeves into a large iron casting *A*. This casting not only holds the sleeves in alignment, but also serves as a water tank to keep them cool when the engine is in operation. The sleeves are lapped to a diameter of 6 1/4 inches, and are 13 1/2 inches long. Plus or minus limits of 0.0005 inch are specified for the diameter and for the straightness of the bore.

Boring, reaming, and rough-grinding operations are performed on the cylinder sleeves before they are inserted in the water-tank casting. In the lapping operation, the finished lower side of the tank is seated on accurate parallel bars *B* laid on the table of the drilling machine. The table top is constructed of heavy I-beams leveled with care. Lapping tool *C* is reciprocated up and down in each bore by power for about twenty minutes to finish the bore to the required size, which is determined by applying an inside micrometer. The lapping tool makes about four strokes per minute. It is customary to lap away about 0.004 inch of stock on the diameter. Ordinary cutting oil is copiously supplied to the lap during the operation, and this is considered an important factor in its success. Guard *D* is ordinarily placed at the top of the cylinder bore being lapped in order to prevent splashing of the oil.



Lapping a Six-cylinder Unit of a Motor-boat Engine

* * *

INNOVATION IN ASSOCIATION PUBLICATIONS

The Merchants' Association of New York has developed an entirely new and highly commendable idea in the publication of its association bulletin. Instead of publishing a large journal, the association limits its publication to what is known as the "Service Bulletin," the idea being to present all information of importance to the members in as brief and concise a form as possible. The items are presented in facsimile typewritten form and are boiled down to brief statements, as if telegraphed, and only such information is given as is deemed of definite service to the membership. The bulletin is issued on the loose-leaf plan, with a blank space at the top, so that the different items can be conveniently directed to different members within an organization. If any lengthy subjects have to be treated, they are included as inserts, and can be kept or not, according to the needs of the member of the association. Such enclosures as the "legislative service" are also separate from the news service, as many people wish to file away the legislative reports separately for reference.

In view of the great mass of material published in association bulletins, much of which the members cannot possibly find time to read, this new departure of the Merchants' Association of New York is worthy of study; many associations could probably follow these ideas to advantage.

CENSUS OF MANUFACTURES

In the annual report of the Director of Census to the Secretary of Commerce, a brief history is given of the census of manufactures, which is now taken every two years and covers nearly 400 industries. Prior to 1900 the census of manufactures was taken only at ten-year intervals in connection with the regular decennial censuses of population and agriculture. The act of March 3, 1902, contained a provision for a five-year inquiry, and four quinquennial censuses were taken thereunder, the first for 1904 and the last for 1919. The act of March 3, 1919, provided for a biennial census of manufactures, and under this law the censuses of 1921 and 1923 were taken.

The shortening of the period between censuses and the consequent reduction of the time allowed for the collection, compilation, and publication of the statistics have necessitated, at each step, a change in the scope of the census. Prior to 1900 the decennial census of manufactures covered the so-called "hand and neighborhood industries," but when the census was placed on a five-year basis it became necessary to eliminate these minor industries, and also to restrict the census to establishments conducted under what is known as the factory system and whose output during the census year was valued at not less than $500. In this way a reduction of approximately 300,000 was made in the number of establishments to be canvassed.

The inauguration of the biennial census necessitated a still further reduction in the number of establishments covered, and upon the recommendation of industrial and trade organizations, the principal tabulations were restricted to the data reported by establishments whose products during the census year were valued at $5000 or more, such establishments having reported at the previous census only three-tenths of 1 per cent of the total value of products and five-tenths of 1 per cent of the total number of wage earners. By this action the number of establishments covered by the principal tabulations was reduced from approximately 290,000 for 1919 to 196,000 for 1921 and 1923.

Although the number of statements collected was below 200,000, it was necessary to make a half million requests for their return. By the most extensive use of the mails, only about 130,000 schedules could be obtained, leaving approximately 70,000 to be collected by agents in the field. Of the 130,000 received by mail, approximately 50 per cent were correct or could be corrected in the office, the remainder being so incomplete as to necessitate their return to the manufacturers for fuller information. In connection with the completion and correction of the returns received by mail, it was necessary to send approximately 100,000 letters of inquiry to individual manufacturers. This lack of care in the preparation of the census schedules results in increased cost, and delays the tabulation of the data.

REPAIRING SHAPERS AND DRILLING MACHINES

By JACOB H. SMIT

Many shapers that have been in use for some time are out from 0.001 to 0.020 inch and more in the length of the stroke. If the time that it takes to grind or otherwise straighten surfaces machined on such a shaper is figured, it will be apparent that it would be economical to devote a day or two to truing up the machine. The play of a heavy ram should not be determined by feel; place an indicator in contact with the side of the ram close to the front of the frame, and have someone shake the ram sideways at the rear, in order to determine its looseness in the bearings. The same procedure should be repeated with the indicator in contact with one side of the ram at the rear end of the frame and someone shaking the ram at the front. A play of 0.001 inch is enough clearance, and if there is more, the gib should be tightened up. If the ram is not badly worn, this correction will suffice, but in the case of excessive wear, it is necessary to scrape the ram and the corresponding frame surfaces as will be described later. After the ram has been adjusted, clean off the vertical and longitudinal slides and adjust them, and then take a light cut off the top of the table without using the supports for bracing it.

It is well to disassemble the vise and take a light cut off the bottom and, if necessary, off the swiveling base. Then remount the vise and take a light cut off the surface on which the jaw slides. If this is done, the work may be cut evenly, even though the vise is swiveled in the operation. Take a light cut off the vise jaws if necessary in order to make them square.

To test the tool-slide for squareness, clamp a square on the jaw-bearing surface of the vise with one leg vertical, fasten an indicator in the toolpost, and indicate the vertical leg of the square as the tool-slide is moved up and down. One source of much trouble in machines is due to worn thrust faces of feed-screw collars. The feed-screw may be revolved to move a slide, say, 0.005 inch, without budging the slide; again, the screw may be revolved a similar amount, still without starting the slide; finally, when the screw is revolved once more to move the slide a few thousandths of an inch, the slide may jump as much as 0.020 inch all at once, and spoil the work. The reason for this condition is that the feed-screw bearings have worn large and the thrust faces of the collars uneven. Hence, as the feed-screw is revolved, the high places on the faces of the collars climb on and off the uneven surfaces with which they contact, and this causes the screw to feed irregularly.

Repairing a Shaper Thoroughly

If the shaper is to be thoroughly repaired, the ram, frame, and slides must be scraped. If the screws that hold the gib in position are loose in their tapped holes, by all means provide tight fitting screws or else check-nuts for them. If a ram wobbles because of a loose gib, it will wear on the ends and will also wear the corners of the frame.

The cross-rail should be taken off, scraped on the top and front, and then remounted. For checking the squareness of the cross-rail with the ram, a square may be clamped against the front of the cross-rail with both legs horizontal. By moving the ram, apply an indicator held in the toolpost against the edge of the leg that projects forward. Then if the square is clamped with one leg vertical against the cross-slide and the other projecting toward the front of the table, and the indicator is run along the leg projecting forward, the vertical finished face of the frame can be checked. If this face is out of true, the narrow back sides of the cross-rail can be scraped to suit. When the cross-rail has been corrected, the cross-feed apron and gib should be scraped and reassembled, a cut taken over the top of the table, and the vise finally squared up, as explained at the beginning of this article.

Sometimes there is a "knock" in the shaper that should be eliminated; as little as 0.002 inch of play in the top pin-hole of the rocker arm will produce a noise when the shaper is being run at high speed. If the condition is to be remedied by means of a new pin, scrape the hole round first, even if it has been reamed out. Scrape the high spots in the hole by driving the pin in several times, until the pin is a snug fit. Necessary repairs should also be made to the crank mechanism and the gears, and if keys must be replaced, it is well to make them out of tool steel so that they will last longer when subjected to severe strain.

Tightening up the Spindle of Drilling Machines

When holes are not drilled straight by a drilling machine, many mechanics think that the table is at fault and that truing it up will remedy the defect. Sometimes this is true, but in the majority of cases, it is the spindle that causes the trouble. This is because the spindle sleeve becomes loose in its housing and the spindle becomes loose in the sleeve. A play of only a few thousandths inch in the sleeve accumulates appreciably at the point of the drill.

The remedy is to file, turn, or grind down the spindle and provide a new sleeve, or bush the ends to suit the spindle. A new babbitt bearing or a ball bearing, depending upon the construction, should also be furnished. It is less work to recondition a drilling machine than is generally thought.

* * *

STANDARDIZATION DOES NOT RETARD PROGRESS

A statement of considerable interest relating to standardization was contained in a paper by C. L. Warwick, secretary-treasurer of the American Society for Testing Materials, presented at the First Pan-American Standardization Conference. In this paper Mr. Warwick called attention to the importance of standardization in relation to future industrial developments, emphasizing that this importance can hardly be overestimated. Our industries, within comparatively recent times, have multiplied very rapidly, and not sufficient attention has been paid to the economies that are possible in simplifying types, designs, and dimensions of commodities, and in standardizing materials and practices. In its essentials, standardization is simply a process of selection of types, designs, materials, or practices that in the course of time have thoroughly proved their value to the general community—a sort of "survival of the fittest," and a concentration upon these types and materials in production and use in the interests of greatest efficiency. Only recently have the comparatively chaotic conditions in which industry has found itself in this respect, due to its very rapid development, awakened us to the necessity of applying the principles of standardization to problems of production, distribution, and consumption. If these principles are properly applied, little apprehension need be felt that standardization will weaken the incentive to originate, to invent, and to apply in the industries of the world desirable new types, new materials, and new processes.

Standards are accused of "fixing" practice in such a way as to retard desirable progress in industrial development. The fallacy of this criticism is evident as soon as one appreciates that standards simply express the results of experience in the successful use of commodities and really conserve our time and energy for the study of new developments that otherwise would be occupied with routine matters. Changing experience as influenced by new developments is in due course reflected in our standards. The existence of a long-established standard specification for a given material that is widely used for a given purpose does not prevent some one from developing a new material that is more satisfactory for that purpose. The extent to which the new material will replace the old is a matter essentially of economic considerations, such as price, dependability of supply, and the like. When conditions in the industry warrant it, a standard specification is developed to govern the purchase of the new material, and is used side by side with the older specification so long as the trade continues to use the older material to any appreciable extent.

Testing Planer Gears

By CARL E. LINDEN, Cincinnati Planer Co., Cincinnati, Ohio

MANY users of planers believe that any commercial gear is satisfactory for the main drive of this type of machine, but the fact is that the gears must be true within close limits in order to obtain a satisfactory drive. To insure accurate gears in planers built by the Cincinnati Planer Co., Cincinnati, Ohio, use is made of a special testing fixture that may be employed with all large spur, helical, or herringbone gears. This fixture is illustrated in Fig. 1, set up with a large herringbone gear.

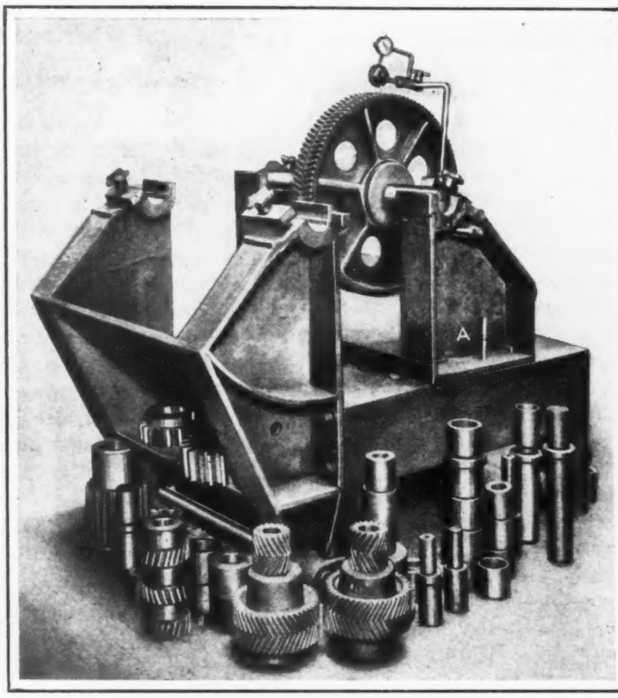


Fig. 1. Fixture used in checking the Accuracy of Gears used in the Main Drive of Planers

There are two sets of bearings in which the shafts of two gears may be mounted so that the gears will mesh together, as shown in Fig. 2. One set of bearings, which is contained on slide *A*, is movable along the base to suit different center distances between the gears. Slide *A* is moved on a narrow guide *B* by means of a screw in the center of the guide. A micrometer dial on the same end of the screw as the crank handle enables accurate settings of the slide to be made. Each gear shaft is supported on both ends to avoid errors due to overhang. Provision for testing gears rapidly has been made by cutting away the top halves of the bearings, which enables the inspector to mount and remove shafts quickly.

Several sizes of shafts and bushings are on hand to suit any job that comes through the shop. In a case where the hole in the gear is larger than the maximum sized shaft that can be used in the bearings, a bushing, such as seen on the floor at the right in Fig. 1, is placed in the hole. Bushings are also used when shaft ends are smaller in diameter than the bearings. Different sizes of shafts are shown in the foreground of the illustration Fig. 2.

In testing a gear in this fixture, a little ball attached to the lower end of spindle *C*, Fig. 3, is successively placed between all the teeth of the gear to check their thickness along the pitch circle and to test the concentricity of the gear. Before the actual test, a master gear of the same diameter, diametral pitch, and number of teeth as the gear to be tested is placed in the fixture, and with the ball of spindle *C* resting between two teeth, the indicator of dial *D* is made to register zero. Then, when this ball is placed between the teeth of the gear to be tested, any deviation of the dial indicator from zero will show that there is an inaccuracy in the teeth. Bar *E* fulcrums on pin *F*, and a spring is provided at the right-hand end of bar *E* so that the ball of spindle *C* will always be forced with the same amount of pressure against two gear teeth. It will be apparent that balls of different diameters are required for gears of different diametral pitches. Both helixes of herringbone gears can be tested.

After a mating gear and pinion have been found correct within the specified limits, they are run together, as illustrated in Fig. 2, at the correct center distance, to determine whether or not there is excessive backlash. Before this is done, however, a master pinion is first revolved with the gear to make sure that the gear is accurate.

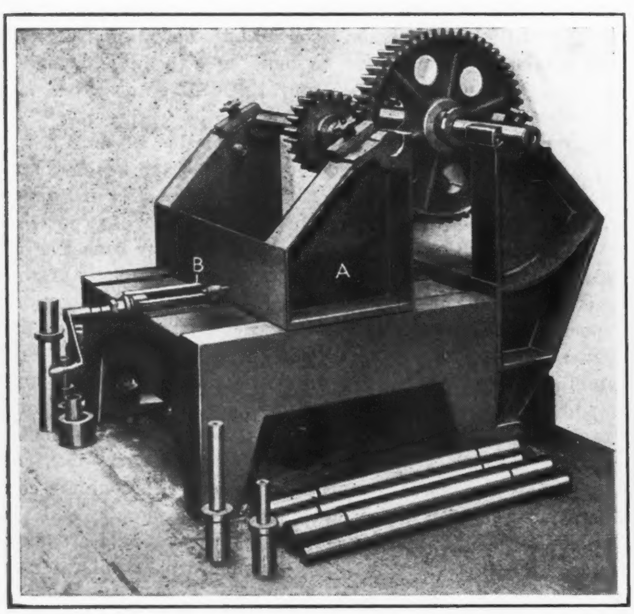


Fig. 2. Fixture set up with Two Experimental Spur Gears at the Correct Center Distance

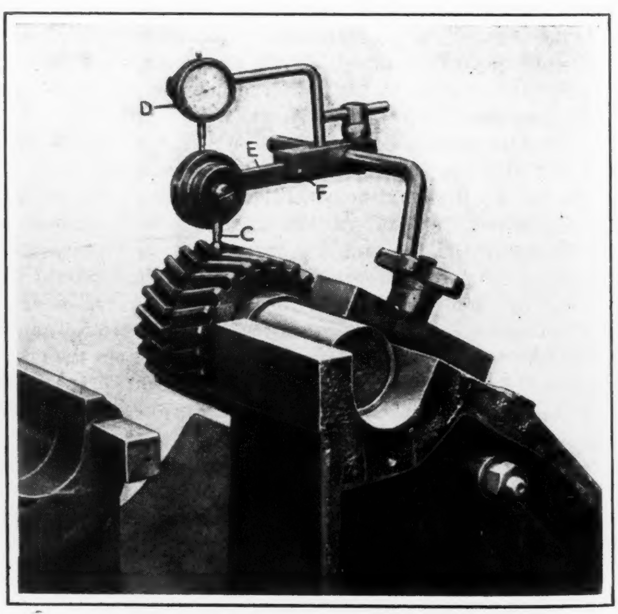


Fig. 3. Procedure followed in checking the Teeth of Gears and Pinions with Fixture shown in Figs. 1 and 2

Letters on Practical Subjects

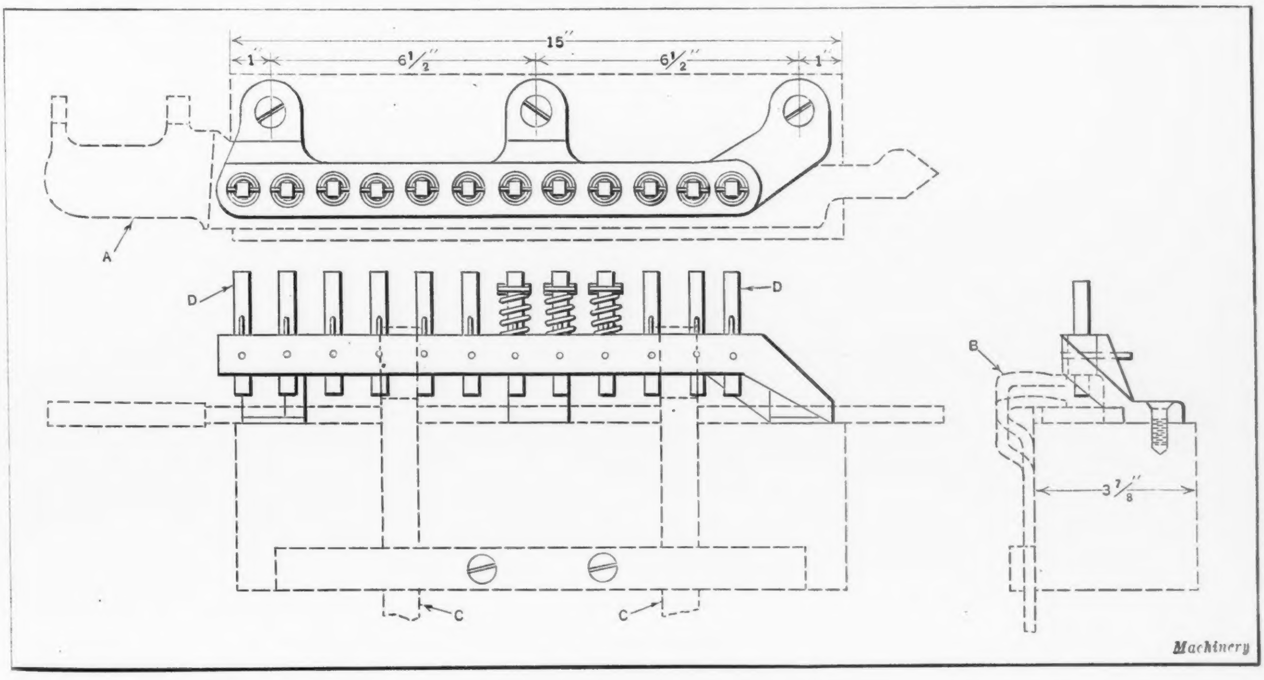
FIXTURE FOR STAMPING SCALE BEAMS

In the accompanying illustration is shown a fixture designed for use in stamping figures on the beams of weighing scales. By the use of this fixture the time required for stamping was cut down to less than one-third of that previously spent in stamping the figures by hand-locating methods. The finished beam also presented a much better appearance and was free from errors.

In using the device, the first step is to place the beams to be stamped in a convenient position at the side of the workman. A beam, indicated by dotted lines at *A*, is then placed under the fixture and aligned by means of the lugs. The clamp *B* is brought down by operating a foot-pedal attached to straps *C*. Each of the twelve punches *D* is then struck a blow with a hammer, after which the beam is removed and the same operation repeated on a new piece. Of course, the lower end of each punch has a stamping die engraved upon it which stamps the required figure on the beam.

When all the beams have been stamped on one side, the fixture is changed, and the opposite side of the beams stamped in a similar manner, the fixture shown being replaced by one of the opposite hand. The change of fixtures is easily accomplished by removing the three flat-head screws shown in the plan view of the illustration. By the old method, the workman was required to inscribe a line on each side of the beam to enable him to align the figures. Following this step, the figures were stamped, using a different punch for each figure. By the latter method the most skilled workman could not avoid having the figures slightly out of line. The new fixture proved so satisfactory that similar types are now used in all the company's factories.

Drummondville, Quebec, Canada STANLEY H. PHILLIPS

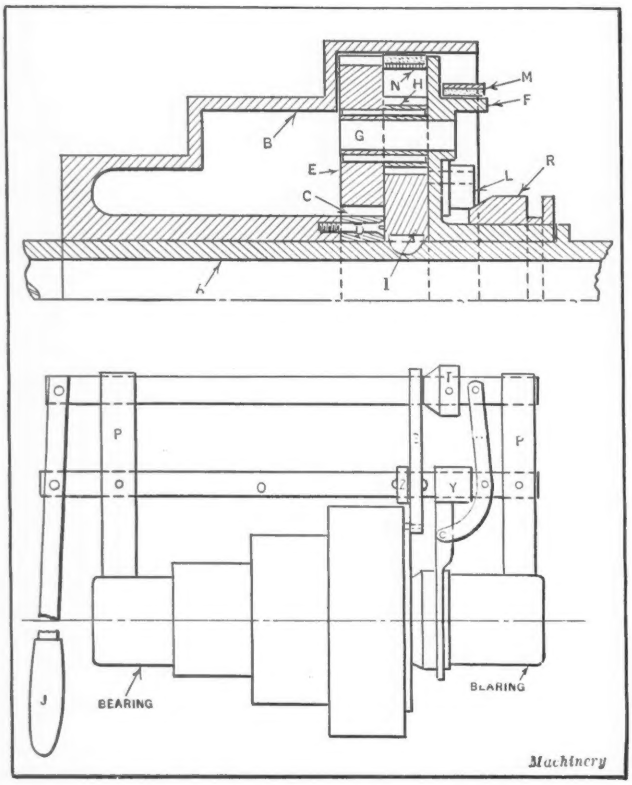


Fixture used in stamping Scale Beams

PLANETARY GEARING FOR LATHE HEADSTOCK

In the operation of machine tools, particularly engine and turret lathes, it is frequently necessary while working on a single piece to change the speed of rotation of the spindle. This is now accomplished in several ways. In the conventional back-geared lathe, if a change from the open belt to the back gear is desired, the operator must stop the machine. With the planetary back-gearing to be described, the operator simply pulls or pushes a lever, and the change is made, regardless of the speed at which the lathe is running.

For all small or medium sized engine or turret lathes this planetary back-gearing is noiseless and efficient either on high-speed work or on the job that requires real "hogging." The application of this type of gearing to a lathe head is very simple. It consists of a train of reducing gears driven



Arrangement of Planetary Gearing in Cone-pulley and Lever-operated Speed-control Mechanism

by the ordinary cone pulley and driving the spindle, together with the necessary mechanism required to shift the open belt to the back-gearing, or the reverse.

The illustration shows the third device of this kind the writer has built, this one being in the cone of a turret lathe, while the other two of different design are driving engine lathes. In detail, the regular cone pulley *B* on the spindle *A* has attached to its hub the spur gear *C*, held in place by the screws *D*. This gear meshes with *E* to which is riveted the gear *H* meshing with gear *I*, the latter being keyed to the spindle. The cast-iron disk *F* floats freely on the spindle and is provided with a cylindrical flange carrying the low-speed friction band *M*. It also has two bosses for the insertion of the spindles *G* on which the gears *E* and *H* rotate.

The low-speed friction band *M* is carried around the drum on disk *F*, its ends being formed in loops in which are thrust pins extending from the rocking levers *S*. The high-speed friction band *N* is exactly like the internal brake on an automobile. Its center is attached to the disk *F*, and its ends are expanded by a double cam attached to the end of the shaft carrying the lever *L* so that when the cone *R* is thrust under *L* the cams expand the band *N*. This section is shown enlarged to illustrate the details more clearly. The planetary gearing shown is duplicated on the other side of the spindle.

In the plan, showing the method of operation, the brackets *P* are attached to the lathe head, and the rod *O* is pinned in these brackets. The shifting device consists of the hand-lever *J* which is freely movable on the pin attaching it to *O*. A pull to the right engages the low or back-gearing while a thrust to the left brings in the high or the "open belt." The lever is shown in the neutral position. If the operator pulls the lever, the cylindrical portion of cone *T* slides between the ends of the two rocking levers *S*, and these ends are forced apart. As the levers are pinned on *Z*, when their outer ends are pushed apart, their inner ends, being attached to the friction band *M*, clamp this band on the disk *F*, retaining *F* in a fixed position; the cone pulley then drives the spindle through the reducing gears, thus giving the low speed. A push on lever *J* forces cone *T* out of engagement with levers *S*, and if this movement is continued, the lever *W*, through the fork *Y*, drives the cone *R* under *L*, which causes the double cams to expand *N* and thereby lock the whole device together, giving the direct or "open belt" drive.

To illustrate the application of this rapid speed-changing mechanism by referring to one of many examples that might be mentioned, a certain sprinkler cap requires finishing on the base and inside and a 5/16-inch hole drilled through the center; this is done at about 600 revolutions per minute. This cap must be tapped to a diameter of 1 5/8 inches, 16 threads per inch, and 4 threads deep. As the turning speed of 600 revolutions per minute is too high, a shift of the lever instantly reduces the speed to 100 revolutions per minute; then after tapping, another shift of the lever engages the higher speed. The convenience in making these changes without stopping results in saving considerable time on many classes of work.

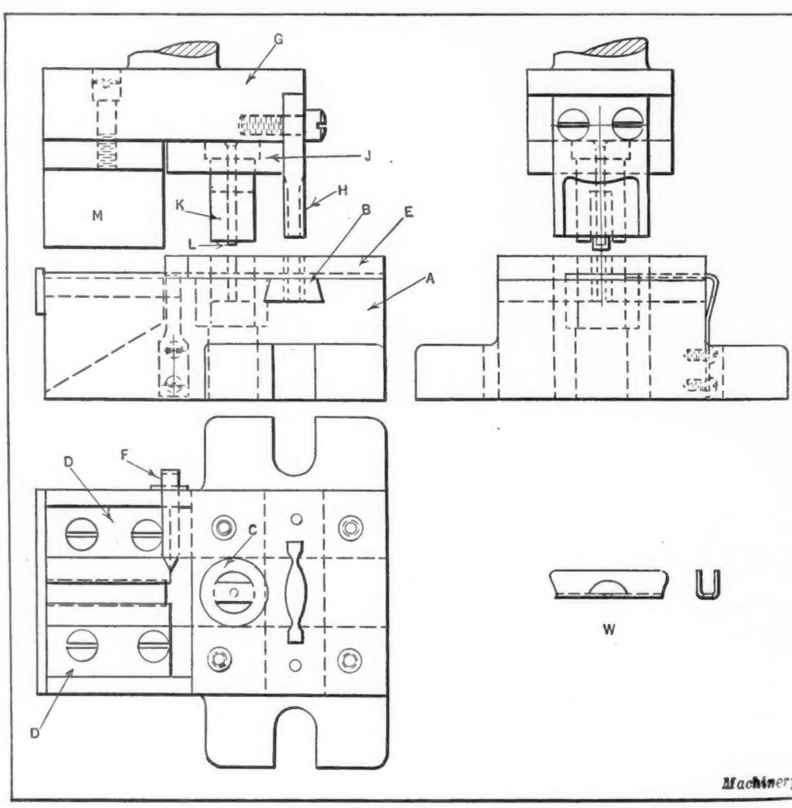
Los Angeles, Cal. DR. CHARLES W. SNYDER

BLANKING, PIERCING AND FORMING DIE

The wing-nut shown at *W* in the accompanying illustration is an example of a piece of work which, while complicated in shape, is made in a simple die. The stock used is polished cold-rolled steel, 1/16 inch by 1 inch, which comes in 6-foot lengths. The die shown has a cast-iron shoe *A* which contains the dovetailed shearing die *B*, the piercing die bushing *C*, and the forming strips *D*. The stripper *E* is grooved out to take the stock and has a cross-slot in it for the locating spring-stop *F*.

The punch consists of the machine-steel punch-holder *G* to which the shearing punch *H* and the punch-plate *J* are secured. Plate *J* holds the piercing punches *K* and *L* to the face of the punch-holder. In a slot in the rear of the punch-holder is located the forming punch *M*.

When the die is in operation, the stock is fed into the stripper so that the operator can see the end through the



Die for producing Wing-nuts

shearing punch opening in the stripper. The press is then tripped and the end of the stock is trimmed off so that when it is advanced and comes up against the spring-stop *F* a complete perforated blank is cut off. The stock, again being fed into the die, pushes the blank into the forming position. When the forming punch descends, it drives the blank down between the forming strips *D*, and as the forming punch recedes, the formed wing-nut is stripped from the forming punch by the shoulders on the forming strips *D*, and falls through the recess in the die-shoe *A* into the work-box at the back of the press.

Brooklyn, N. Y. S. A. McDONALD

RATCHET DIAL FEED FOR PRESS

A limited quantity of small parts, of a design that could be made most economically on a dial feed press, was required. As the comparatively small quantities to be produced did not warrant the purchasing of a new machine, the dial feed shown in Fig. 1 was designed and applied to an old press. In Fig. 2 is shown the rocker-arm mechanism used to operate the ratchet feed.

On the last part of the up stroke of the press ram, the eccentrically located stud *A*, on the end of the crankshaft, carries the upper end of the rocker arm *B* to the left. As this arm is pivoted on the stud *C*, the lower end is carried forward, causing the ratchet slide *D*, Fig. 1, to be advanced. The pawl *E*, pivoted on the stud *F* in slide *D*, engages one of the notches in the dial-plate *G* and indexes this member to the next station. At the completion of the cycle, point *H* on lever *J* drops into the notch on plate *G*, locking this member during the down stroke of the press ram and the first part of the upward stroke. The dial-plate *G* is therefore locked while the dies are in operation.

As the slide *D* approaches the end of its rearward movement, it comes in contact with the end of lever *J* and lifts the locking point *H* from the notch in plate *G*. While the point *H* is still held away from plate *G* the point of pawl *E* drops into the indexing notch. When slide *D* has moved forward far enough to permit point *H* to come in contact with plate *G*, the indexing notch at *K* has moved from under point *H*, which then rides on the periphery of the plate until pawl *E* has completed the indexing movement, at which time it drops into the next notch.

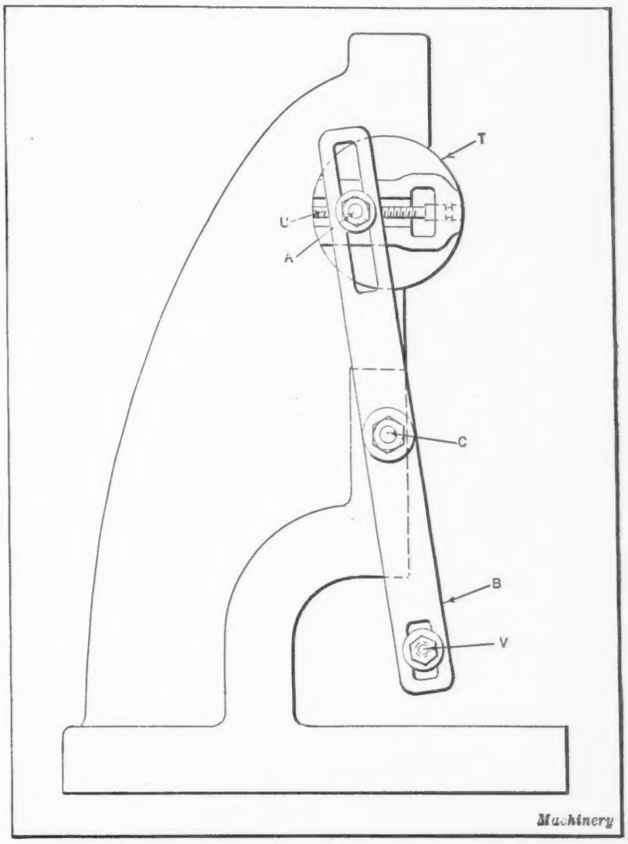


Fig. 2. Rocker Arm used to operate Dial Feed

The dial-plate *G* is shown blank, without the work stations cut in it, in order to eliminate unnecessary details. The dial-plate is made a good running fit on the stud *L*, which is driven into the die-bed *M*. The die-bed is provided with a flange which supports the dial-plate. A friction washer *N*, made from wood, is held in contact with the upper face of the dial-plate by the washer *O* and nut *P*. The bracket *Q* in which slide *D* operates is provided with an adjustable gib to compensate for wear on the dovetail faces of the bracket and slide.

The flat spring *R* serves to keep the pawl *E* in contact with the dial-plate. The locking point *H* is made from tool steel, and is rigidly secured to the arm *J*. The flat spring *S* serves to hold the locking point in contact with the plate. The cast-iron head *T*, Fig. 2, secured to the end of the crankshaft, is fitted with a slide in which the stud *A* is held. This slide may be adjusted by the screw *U* to give the rocker arm the required throw. A flattened bronze bushing is placed on stud *A*, which is a good sliding fit in the slot in arm *B*. A similar bronze bushing is provided for stud *V*.

Bridgeport, Conn. J. E. FENNO

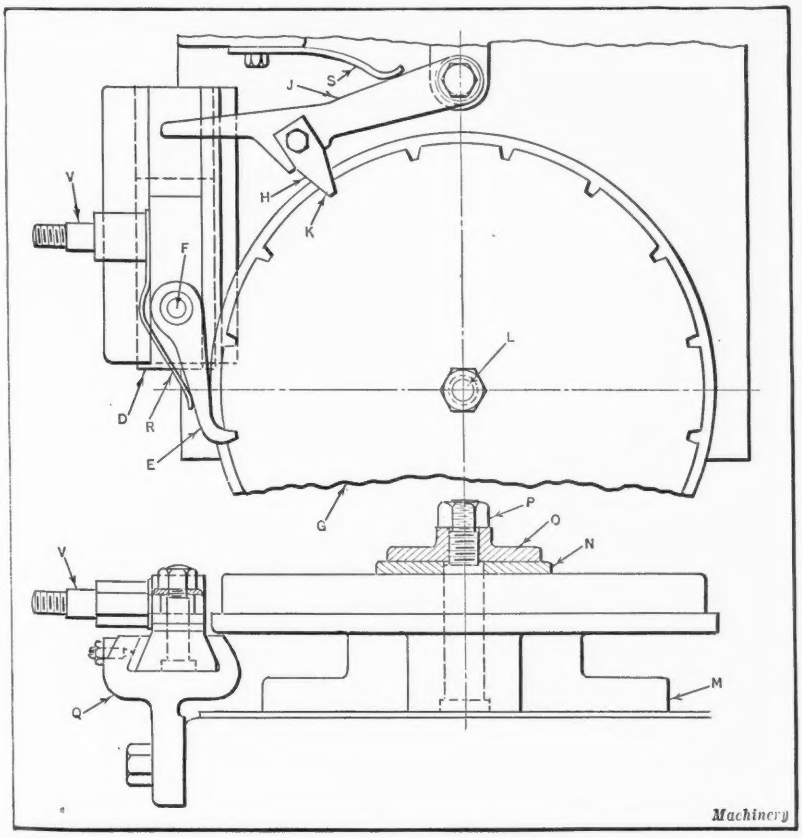


Fig. 1. Ratchet-operated Dial Feed for Press

FLANGING WHEEL DISKS ON BORING MACHINE

The method of flanging steel wheel disks on a boring machine illustrated in Figs. 1 and 2 is employed in the plant of the Reliance Trailer & Truck Co., San Francisco, Cal. The steel disk *A*, Fig. 1, which is to be flanged, is placed on the forming base *B* and clamped down as shown. The forming base is secured to the boring mill chuck. After the disk to be flanged is clamped in place, the boring mill spindle is set in motion, and the cone-shaped forming tool *C* is fed over so that the lower

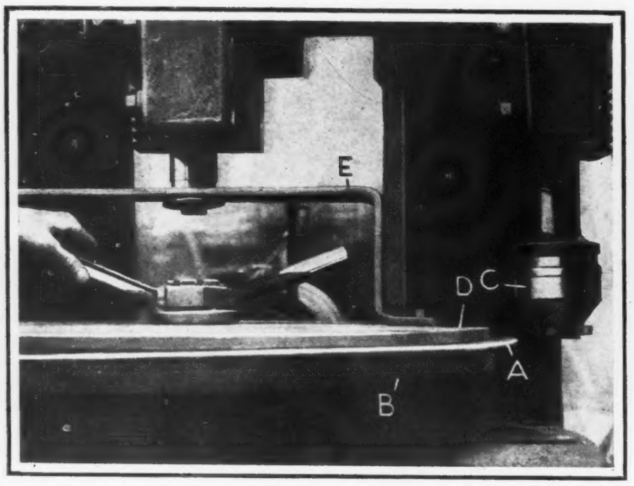


Fig. 1. Wheel Disk in Place, Ready for Flanging Operation

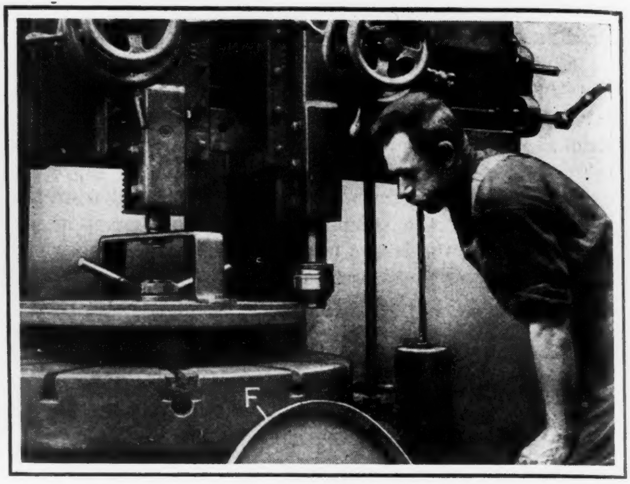


Fig. 2. Tool in Position for flanging Wheel Disk on Boring Mill

part comes in contact with the edge of the revolving steel disk *A* which extends beyond the heavy steel clamping disk *D*.

By manipulating the tool-holder on the boring machine, the cone *C* is made to exert sufficient pressure on the edge of the work to roll it over the base *B*, as shown in Fig. 2, thus producing the required flange. This rolling operation requires about seven minutes. The clamping disk *D* is supported by a metal bracket *E* secured to one of the boring mill tool spindles and is raised and lowered by the handwheels ordinarily used to control this spindle. This greatly facilitates placing the work in the proper position for flanging, and also assists in removing the disk after the flange has been formed. One of the disks on which the flanging operation has been completed is shown at *F*, Fig. 2.

San Francisco, Cal. CHARLES W. GEIGER

MACHINE DATA FOR TOOL DESIGNERS

The work of designing jigs, fixtures, turret lathe tools or, in fact, any machine tool equipment is greatly facilitated by providing the designers with machine data that clearly indicates the points of possible interference and the capacity of the various machines on which the special tool equipment will be used. Of course, the experienced designer need not be cautioned about designing tools or fixtures without first having obtained this data, and if it is not available in the drafting-room he will go into the shop and measure up the machine before starting to design the tool equipment.

In Fig. 1 is shown a diagram such as is required by a tool designer when making up tool equipment for a turret lathe. This diagram shows the portions of the machine on which the tool equipment will be mounted. The upper view of the illustration shows the cross-slide, and gives the dimensions of the front cross-slide block *A* and the rear cross-slide block *B*, the distance between the two blocks, and the swing over the cross-slide, as well as the extreme feeding range of the slide.

The turret-slide diagram shown in the lower view enables the designer to so dimension the tools that they will fit the turret. These dimensions also show the maximum length a boring-bar can have without interfering with the over-arm support. Below the diagram are brief notes relative to the turret feed and the total turret travel, which means the amount of travel required to index the turret-slide, inclusive of the feed, which must be taken into consideration in calculating the allowable length of a boring-bar pilot. This diagram is intended only to give an idea of the requirements of the tool designer; of course, the kind and amount of information given in connection with such diagrams varies with different types and makes of machines.

The dimensions and other data required in designing punches and dies for a certain punch press are given in the diagram Fig. 2. On this diagram are given the dimensions of the bolster on which the dies are mounted, the size of the opening in the bed of the bolster, and the amount of overhang at the back of the bolster.

Holyoke, Mass. FRANK H. MAYOH

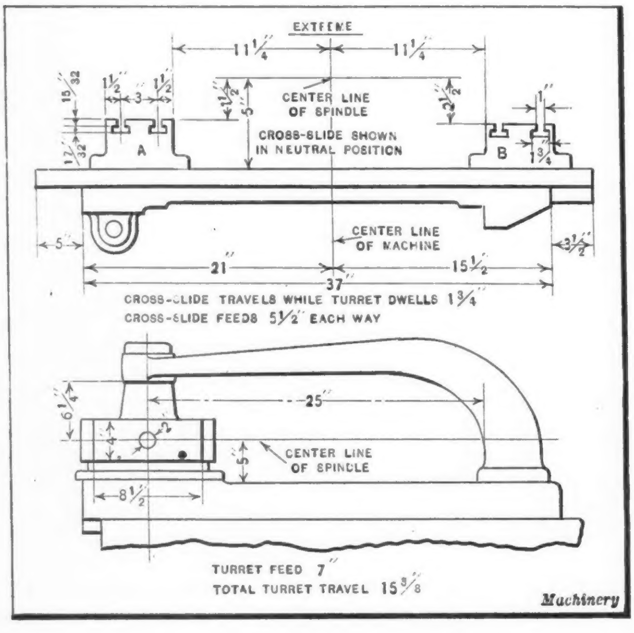


Fig. 1. Turret Lathe Data for Tool Designer

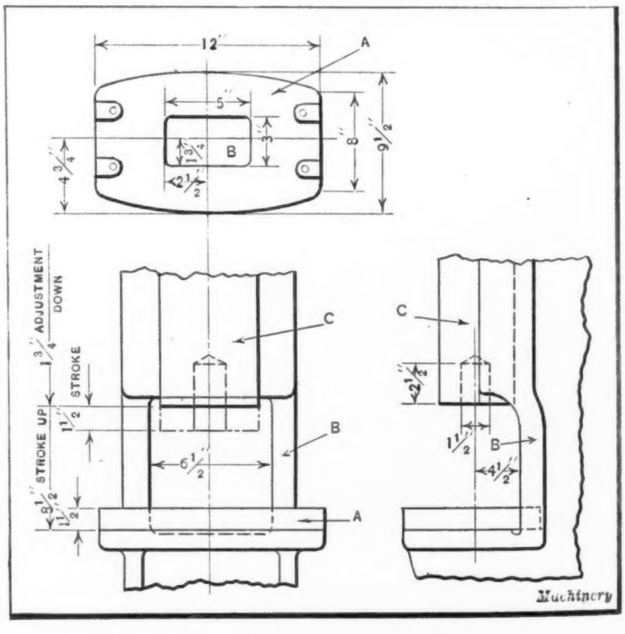


Fig. 2. Data required in designing Dies for a Punch Press

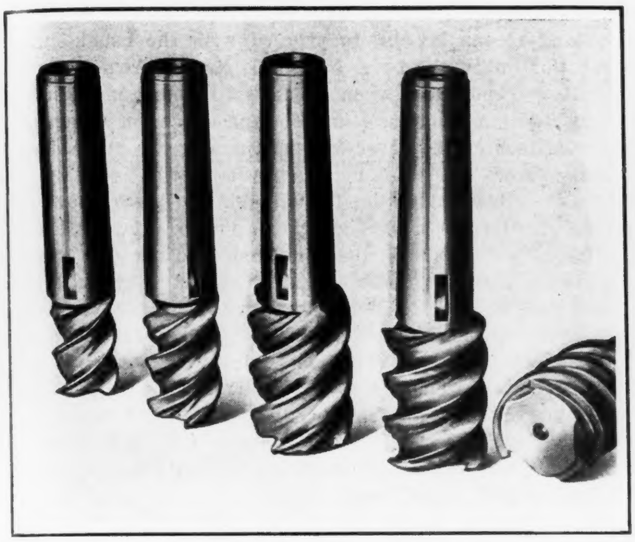


Fig. 1. Cutters used to mill Grooves in Cams shown in Fig. 2

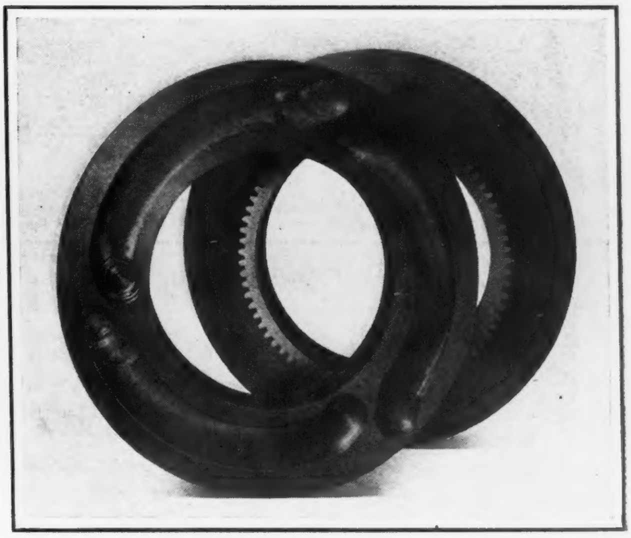


Fig. 2. Cams in which Grooves are milled by Cutters shown in Fig. 1

CUTTERS FOR MILLING CURVED GROOVES

The milling cutters of rather unusual design shown in Fig. 1 were designed for milling the slots in ring cams, two of which are shown in Fig. 2. The slots are 1 1/2 inches wide and 9/16 inch deep, and are milled in a forging of tough steel which is previously turned and bored. The cams are made on a productive basis, and considerable difficulty was encountered in cutter breakage when the ordinary type of end-mill was used. The cutters shown are the result of considerable experimentation, and the results obtained with them are highly satisfactory.

The cutters are rough-turned from high-speed steel and fluted on a Pratt & Whitney thread miller. The largest cutter, 1 1/2 inches in diameter, used for finishing the slots, has four flutes milled with a 3-inch lead, while those under that size have three flutes with a 2-inch lead, and in the milling operation, one roughing and one finishing cut is taken in each slot. However, the entire surface of each slot is machined at each cut. To facilitate starting the slots, a hole is first drilled at the starting point at the end of the slot.

As the cutting pressure is upward, it has a tendency to extract the cutter from the spindle and cause breakage. Therefore, the shanks are drilled and tapped in the ends to receive a draw-rod which extends to the opposite end of the spindle. The threaded ends of the shanks are chamfered 60 degrees to receive a standard center, so that after hardening, the cutters can be placed in the thread milling machine again and a toolpost grinder used to grind the entire edge and the clearance angle on the flutes. The cutting action is continuous, and as the bottom end of each cutter is recessed to meet the bottom of the flutes, the cutters can be sunk readily into the drilled holes in the cam blanks. With this arrangement, there is no clogging of chips when starting a cut.

In Fig. 3 is shown the fixture employed in milling the slots on a No. 3 Brown & Sharpe vertical miller. This machine is equipped with a circular milling attachment to which is secured a holding fixture. The time required for milling the three slots in one cam is approximately 1 1/4 hours.

I. F. Yeoman

Elkhart, Ind.

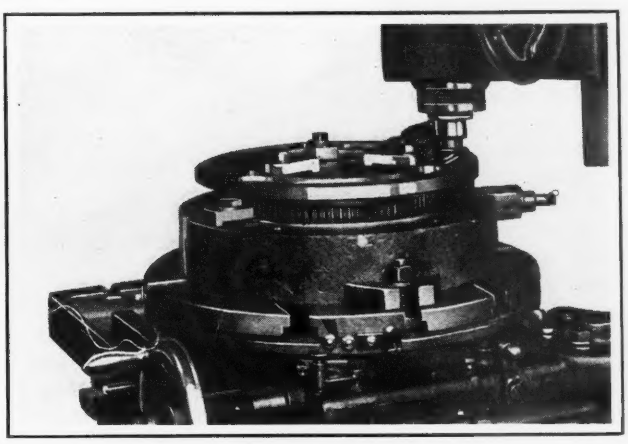


Fig. 3. Milling Grooves in Cams shown in Fig. 2

ALUMINUM ALLOY CASTINGS

Notwithstanding the present extensive use of aluminum by the automobile, air craft, and general engineering industries, this metal will undoubtedly be used to a much greater extent in the future. The endeavor to secure light weight in automobile and air craft construction has led to the development of aluminum alloys as well as alloy steels. The aluminum alloys now available are beginning to take the place of steel for many purposes.

Present-day aluminum alloys are different in every respect from the aluminum used in the first castings. In some cases, aluminum alloys used in automobile construction are withstanding the punishment of road shocks nearly as well as the steel parts they replaced at a considerable saving in weight. Not only has the strength and ductility of this metal been improved, but aluminum alloys have been developed which are better able to retain their strength at high temperatures and resist corrosion, and which also give much higher fatigue values. Aluminum in its pure state is not used for making castings, except in very rare instances, the reason for this being that pure aluminum has a comparatively low tensile strength, and is somewhat difficult to cast successfully. The pure metal is therefore alloyed with some other metal in order to improve its strength, increase its hardness and facilitate casting.

Manchester, England A. Eyles

PLANER ATTACHMENT FOR MACHINING CIRCULAR GROOVE

Although locomotives having the extension-rod type of piston are fast being replaced, there are still a large number in use on various divisions of one of our railroad systems, and each division has its own peculiar method of machining. What seems to the writer to be the best method of handling this work was worked out in the manner described. The extension-rod bearing shown in Fig. 1 was mounted on the bed of a planer equipped with the tool-holding device shown in Fig. 2. This device consists of a clapper *A*, to which is attached a quadrant *B*, held in place by the tapered pin *C* on which the quadrant pivots or rotates when the handwheel *D* is revolved. In taking the fin-

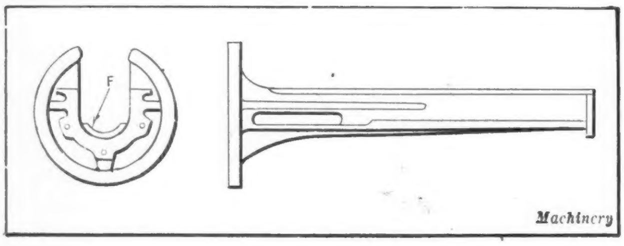


Fig. 1. Piston Extension Support

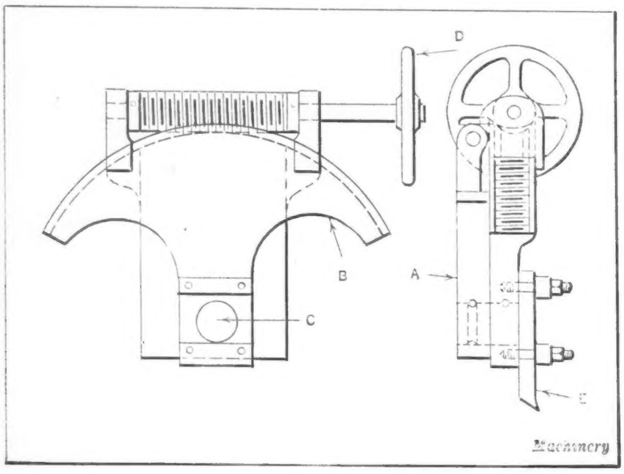


Fig. 2. Planer Attachment for planing Circular Groove

ishing cut on the surface *F*, Fig. 1, it is only necessary to have the point of the tool *E* set the required distance from the center of the pin *C* to give the desired radius. It will be noted that the quadrant *B* is cut away at each side in order to permit it to clear the work.

Rockford, Ill. C. G. Williams

PLANING TO A LAY-OUT ON THE SHAPER

The planing of more or less intricate shapes to a lay-out on the shaper is usually looked upon as an awkward and rather difficult operation. This is due to the fact that the scribed lay-out lines must be at the front end of the piece being machined, which, in using ordinary methods, makes it necessary for the operator not only to assume an unnatural and uncomfortable position in order to see the lay-out, but puts his face, and particularly his eyes, in danger of being injured by the flying chips. There is, however, a method that practically eliminates any necessity for the operator to look at this lay-out while cuts are being taken, permits him to assume the most natural position for operating the shaper, and enables him to work more closely to an accurate lay-out and with more assurance of being correct than by any other practical method that is known to the writer.

Most any lay-out can be roughed out to within 1/32 inch without the necessity for close attention to the lay-out lines, but it is in finishing from this point that the usual difficulties and inconveniences occur. It is also from this point on that the method referred to can be used to advantage. The scheme consists of simply transferring the lay-out from the end of the piece, where often it can scarcely be seen at all, to the top of the piece where it can most readily be seen from the natural operating position, and at the same time magnifying the outline so that the operator can take his finishing cuts with the greatest possible assurance of being right.

Transferring the lay-out to the top of the work is done by simply filing down to the lay-out lines on a long steep angle, as shown in the illustration, so that instead of having a square faced surface 1/32 inch deep to remove, we now have a bevel surface perhaps 3/8 inch or 1/2 inch long, and in plain view, to work upon. It is then only necessary, in working to the lay-out, to proceed with the usual cutting operations until the bevel surface is entirely removed. Under these conditions, when advancing the tool into the cut, every 0.001 inch advance has the appearance of being 0.008 to 0.012 inch on the bevel and the operator can proceed with the assurance that he is not planing too deep.

In the illustration, the file laid on the piece shows the angle at which the bevel should be made. The surface directly under the file is the rough cut and the first step to the right is a light finishing cut. The next step is another finishing cut 0.005 inch deeper than the first, but showing up on the bevel as about 1/16 inch long, and the third step has a depth of cut of 0.010 inch showing on the bevel as about 1/8 inch. The last step to the right shows a cut which is within about 0.003 inch of the finish size, yet showing on the bevel a space still to come off about 1/25 inch wide.

A further advantage of this plan is that there is no possibility of the metal breaking out at the front. With the usual method, it is practically impossible to prevent such breaking out, at least to some extent, even under the lightest cuts. This often destroys the lay-out lines and causes doubt as to whether or not the work is being correctly done. The method described entirely does away with this trouble; the operator always has perfect control over the amount of metal being removed, and full knowledge of how near he is to the finish size, so that he cannot possibly go below the lay-out line without immediately being aware of it.

This method also permits working out forms on the largest shapers where it would otherwise be more or less inconvenient to see the lay-out and to reach the down feed handle at the same time. A scheme often used to advantage when working out round corners, and which is greatly facilitated by the method described, is that of engaging the horizontal

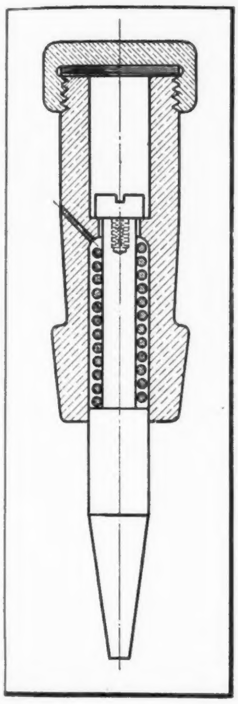
Planing to Lay-out transferred to Top Surface of Work

power feed in the direction away from the work and operating only the down feed by hand. This produces a neater and more uniform result than when both the horizontal and vertical feeds are operated by hand.

Cincinnati, Ohio K. H. Crumrine

Shop and Drafting-room Kinks

NOISELESS TACK-HAMMER



Noiseless Tack-hammer

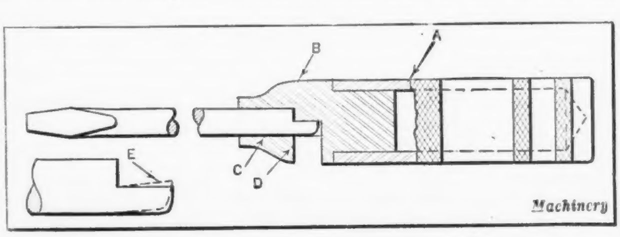
The device here illustrated was designed by the writer to eliminate the excessive noise produced by driving tacks with an ordinary hammer. This device, which may be termed a noiseless tack-hammer, is smaller than most tack-hammers, being a little more than 6 inches long and but 1 3/4 inches at its widest point. It consists principally of a steel rod, tapered at one end and mounted in a brass handle, with a spring backing up the tapered rod. The tapered end is magnetized for the purpose of holding the tack. This feature eliminates the necessity of first fixing the tack in position before driving it into place. In operation, it differs from the ordinary hammer in that the tack is not actually hammered into place but forced in by compression. This hammer is designed to be used chiefly in the drafting-room where excessive noise is objectionable.

RICHARD GREINER

Milwaukee, Wis.

AN INTERCHANGEABLE HANDLE FOR TOOLS

The accompanying illustration shows a useful tool that can be made by any machinist or toolmaker. It consists of a handle and a number of tools that can be inserted in the handle. The shell *A* which forms the handle is drilled out to reduce the weight. The shell is shrunk on the plug *B*, and



Holder that may be provided with Interchangeable Tools

the assembled tool gripped in the chuck, and finished as shown. A hole *C* is drilled in the end as far as the line *D*. At *D* a small recess is filed down to the center of the stock.

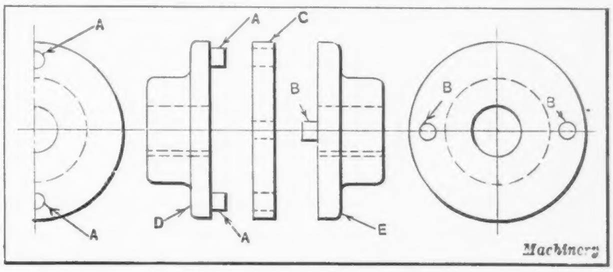
The tools are made of drill rod or carbon steel. The end that enters the handle is filed or milled down half way for a length equal to the length of the recess at *D*. The end of the tool is beveled slightly to admit a screwdriver or a similar instrument for pushing the tool out. The filed end is then bent slightly inward, as shown by the dotted lines at *E* in the enlarged view, and the completed tool tempered. A number of blanks like these can be made up at a time, and then formed into screwdrivers of various sizes, scribers, small scrapers, etc. It is well to make at least two such handles, one of 5/8-inch stock to receive 1/4-inch bits, and another of 1-inch stock for 3/8-inch diameter tools. The various parts may be proportioned or formed to suit the maker.

Cleveland, Ohio EDWARD HELLER

IMPROVISED FLEXIBLE COUPLING

It frequently happens that a flexible coupling is needed in a hurry and one of the required size cannot be purchased locally. In such cases, a coupling like the one here illustrated may be used. It consists of a regulation flange coupling fitted with driving pins *A* and *B*, which engage corresponding holes in a leather or fiber disk *C*, interposed between the two flanges *D* and *E*.

The pins should be made with a shoulder, and should be drive fits in the holes in the flanges. The four holes in the leather disk are spaced 90 degrees apart, and are made 1/32



Flexible Coupling that can be quickly and easily made

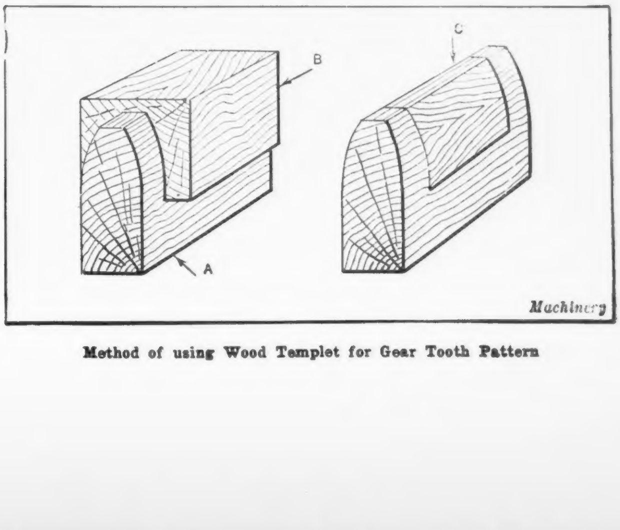
inch larger than the driving pins to permit a free movement of the disk. The flanges *D* and *E* are so adjusted that there is an end play of about 1/16 inch between the leather disk and the flanges. A coupling of the design described will quickly adjust itself to any misalignment of the two shafts. It is suitable for direct connection to any prime mover, and will give excellent service if not overloaded.

Seneca Falls, N. Y. H. L. WHEELER

WOOD TEMPLET FOR GEAR TOOTH PATTERNS

A patternmaker who had been given a "rush" order for several large gear patterns devised the simple method of using a hard wood templet like the one shown at *A* in the accompanying illustration as a guide in cutting or whittling out the pattern teeth from soft wood blocks. The correct tooth form was first laid out on the hardwood block *A*, which was carefully worked down to the tooth profile. A section as wide and as deep as the required tooth was then cut in the hard wood templet. Next a soft wood block *B* was placed in the slot in the templet as shown in the illustration and the surplus material cut away. The finished tooth pattern, as shown at *C*, was then removed from the templet, which was used in the same manner for forming as many teeth as required to complete the pattern.

Drummondville, Quebec STANLEY H. PHILLIPS



Method of using Wood Templet for Gear Tooth Pattern

Questions and Answers

DIE-CASTING DIES

R. C. M.—The writer has been told that dies or molds for die-casting small parts have been made from practically the same materials and by the same methods as are used in making certain kinds of grinding wheels. Will someone who has employed dies such as referred to for the production of die-castings, describe the methods and materials used in making the dies and also tell what kind of work they were used for?

CARBIDE SLUDGE WHITEWASH

A. B. M.—Will you kindly inform me if any use can be made of the residue or sludge from carbide acetylene generators used to furnish gas for oxy-acetylene welding equipment?

ANSWERED BY A. EYLES,
MOSTON, MANCHESTER, ENGLAND

The residue or sludge from the carbide makes a very serviceable whitewash for the workshop, particularly the pits in railroad shops where regular whitewash does not readily adhere to the walls. The sludge from the generating plant may be mixed with water, and is usually spread on the walls by air pressure, the same as ordinary whitewash. It has also been found serviceable as building mortar, and has some value as a fertilizer.

MAKING COPPER TUBES BY ELECTROLYTIC PROCESS

A. G. M.—What is the Elmore process as applied to the manufacture of copper tubes?

A.—In the electrolytic process known as the "Elmore" process, employed for making copper tubes, the copper is deposited on a conducting cylinder which rotates in an acid copper-sulphate bath. The surface of the conducting cylinder is prepared so that the copper will not stick so firmly that the tubes cannot be slipped off the cylinder when finished. The outer surface of the tube being deposited is kept smooth by frequent polishing during the deposition of copper. The same process is also used in making copper sheets by using cylinders of large diameter from which the deposited copper is stripped when the required thickness has been attained.

INDICATOR FOR MULTIPLE THREAD CUTTING

O. L. H.—Can the indicator dial of a lathe be used for spacing the threads of a double-threaded screw of 1/4 inch pitch, or 1/2 inch lead? The lathe lead-screw has six threads per inch and the indicator dial six division lines, one revolution of the dial being equal to 6 inches of carriage travel.

A.—Evidently the dial in this instance is operated by a worm-wheel having 36 teeth. With a wheel of this size, each of the six divisions on the dial equals 1 inch of carriage travel. The dial should also have subdivisions midway between the six main ones, each representing a half inch of carriage travel.

A double thread of 1/4 inch pitch has a lead of 1/2 inch, or two single threads per inch. As the number of single threads per inch is even, the lock-nut may be engaged with the lead-screw when any division line on the dial is opposite the zero mark, and the tool will follow the original cut. Now to make an engagement so that the tool will cut midway between the first groove, or a distance from it equal to the pitch, the zero line should be midway between any two lines on the dial.

MAKING BLUEPRINTS FROM BLUEPRINTS

A. L. B.—The detail and assembly drawing tracings of one of our machines have been accidentally destroyed, but we still have several sets of blueprints. The writer remembers reading or being told about some method of using blueprints to make new copies. If possible, we would like to make duplicate sets of prints from the blueprints we still possess.

A.—According to MACHINERY'S ENCYCLOPEDIA, it is possible to make blueprints from another blueprint, provided the original blueprint is clear throughout and rather dark. If the print is blurred or light, it cannot be satisfactorily reproduced. The original blueprint is coated with kerosene, the printing being done immediately after coating. The oil used will make the original blueprint transparent, but it will not affect the new print unless the kerosene is applied too thickly, and it will not spoil the original blueprint, as it soon evaporates, leaving the print in as good a condition as previously. The same method can be used for making blueprints from drawings made on heavy paper, and it can also be employed for making blueprints from printed matter, provided the printing is done on one side of the sheet only. In that case, the original can also be made transparent by a coating of paraffin applied very hot.

FACTORS FOR CALCULATING STRENGTH OF GEAR TEETH

A. L.—In MACHINERY'S HANDBOOK (page 640 revised edition) there is a table of outline factors for calculating the strength of gear teeth according to the well-known Lewis formula. In Kent's Handbook a similar table appears, but the factors in MACHINERY'S HANDBOOK are over three times as great for a given tooth number as those in Kent's; moreover, Suplee and Halsey both agree with Kent. Please explain why there is such a difference between your factors and those given in the other books mentioned.

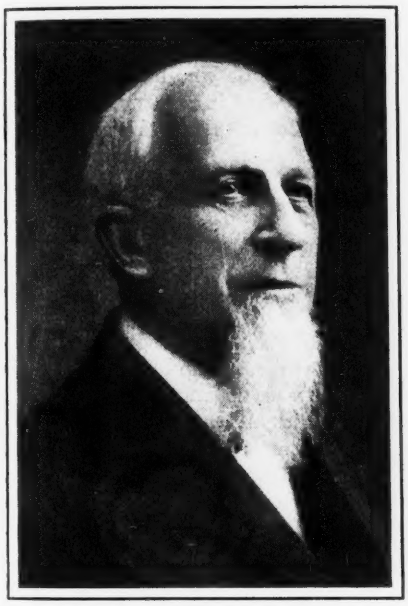
A.—The factors in MACHINERY'S HANDBOOK are based on diametral pitch, whereas those in Kent are based on circular pitch. The factors given in the original paper presented by Mr. Lewis before the Engineers' Club of Philadelphia in 1892 were based upon circular pitch, but since diametral pitch is the system now in universal use for cut gearing, the factors given in MACHINERY'S HANDBOOK have been made to agree with this system, because such a table is more convenient to use in modern gear designing practice. As diametral pitch equals 3.1416 divided by circular pitch, the outline factors for diametral pitch are 3.1416 times those given for circular pitch. On page 639 of MACHINERY'S HANDBOOK, in the paragraph headed "Strength of Gear Teeth," it is explained that the constants Y apply only when the diametral pitch is used. On page 640, in the notation at the head of the table of formulas, it is stated that P equals diametral pitch.

* * *

One of the first installations in this country of an oil engine supplied with scavenging air from a separate, direct-current motor-driven, centrifugal air compressor, has recently been made. The oil engine drives a generator, and is of the Knudsen Diesel type. The compressor is a General Electric machine, rated 1400 cubic feet per minute, 2 1/2 pounds pressure, 3500 revolutions per minute, and is driven by a 115-volt, direct-current motor. Scavenging air is furnished for the purpose of removing the foul gases from the cylinders of the oil engine, this work formerly being done by air supplied from an additional piston on the oil engine. By using the centrifugal compressor, a total reduction in weight of approximately 5 per cent and a 12 per cent reduction in length is effected. Smoothing out the pulsations in the supply of scavenging air is another advantage of the centrifugal unit.

GRATON & KNIGHT SEVENTY-FIVE YEARS OLD

One of the romances of American industry is told in the story of the Graton & Knight Mfg. Co., of Worcester, Mass., which is celebrating its "Diamond Jubilee," this year. Seventy-nine years ago two young men, Henry C. Graton and Joseph A. Knight, went to work in the belt shop of a Worcester card clothing concern. After a few years of labor at the bench, they had accumulated sufficient knowledge and capital to go into the belt business for themselves. So in 1851, in a two-room shop, about 20 by 60 feet in size, was started the enterprise known as the Graton & Knight Mfg. Co., which now markets its products throughout the world. At the beginning, the sum of $800 represented the entire resources of the firm. With the courage, self-reliance, and perseverance characteristic of the early founders of great industries, these young pioneers curried the rough leather, cut it into strips, and laced or riveted the strips together into belts, which they sold to nearby firms.



Henry C. Graton, who started in Business Seventy-five Years ago

For a time the entire working and administrative force was composed of the two members of the firm. After the day's work in the shop was done, Mr. Graton posted the books while Mr. Knight attended to the correspondence. When business fell off, Mr. Graton forsook the currying table and the belt bench and went in search of orders. Mr. Graton, who is now ninety-five years old and is still able to come to the plant occasionally to look over the business he founded so many years ago, delights to talk over those early days.

By 1870 the capital of the company had increased to about $70,000. The yearly pay roll amounted to $25,000, and the annual sales totalled $179,000. From 1870 on, great progress was made. Today, three hundred thousand hides a year are tanned in the tanneries of the company for belting, and those parts of the hide not suitable for high-grade belting are converted into hundreds of other leather products. The company has been awarded medals at five different international expositions for the quality of its products.

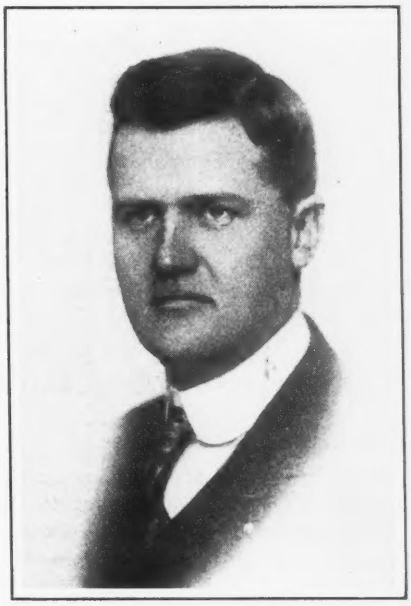
* * *

MACHINE TOOL EXHIBITION IN NEW HAVEN

The sixth annual New Haven Machine Tool Exhibition will be held at the Mason Laboratory, New Haven, Conn., September 7 to 10, under the auspices of the New Haven Section of the American Society of Mechanical Engineers, the Mechanical Engineering Department of the Sheffield Scientific School of Yale University, and the New Haven Chamber of Commerce. The managing committee comprises representatives of each of the sponsor bodies, serving without remuneration in the interest of the engineering public. At the fifth annual exhibition held in September, 1925, over 18,000 people, coming from more than twenty states, and several representatives from foreign countries, viewed the exhibition. There were over one hundred exhibitors, and more than a half a million dollars' worth of machine tools were shown in actual operation. The Exhibition Committee may be addressed at 400 Temple St., New Haven, Conn.

TWENTY-FIFTH ANNIVERSARY OF MOLINE TOOL CO.

The Moline Tool Co., Moline, Ill., celebrated its twenty-fifth anniversary on March 4. On that date in 1901, Wilson P. Hunt, now president of the company, started, by himself, building multiple-spindle drilling machines with continuous spiral drive, in a small shop in Moline, Ill., his equipment consisting of one 14-inch by 6-foot American lathe, one 24-inch Hendey shaper, one 20-inch Silver drill press, and a patternmaker's lathe. In 1902 the business was incorporated, and at that time the first shop, 36 by 80 feet in size, was built. It was the first sawtooth roof machine shop in that part of the country. Since then the business has consisted of designing and building special machinery, in addition to the manufacture of the multiple-spindle drilling machines with continuous spiral drive with which the entire business is identified. The present shop was built in 1916, and now employs about 125 men.



Wilson P. Hunt, who started the Moline Tool Co. Twenty-five Years ago

Mr. Hunt, who started the business twenty-five years ago, was born January 22, 1873. He grew up on a farm, and later learned the machinist's trade at the plant of Williams, White & Co., in Moline. He studied in the evenings, attending night school and taking a course in the International Correspondence Schools. For seven years he worked at the Deere & Mansur Works as designing engineer, and at this time he conceived the design of the first multiple drilling machine with continuous spiral drive. Mr. Hunt is a member of the American Society of Mechanical Engineers and of the American Engineering Council.

* * *

PROVIDENCE MEETING OF A. S. M. E.

A meeting of the American Society of Mechanical Engineers will be held in Providence, R. I., May 3 to 6 under the auspices of the New England Sections of the society, with the Providence Section taking the responsibility of the meeting, acting in cooperation with the Providence Engineering Society. The opening session of the meeting will be held on Monday afternoon, May 3, and will be devoted to industrial education. Tuesday morning the sessions will deal with small parts manufacture, industrial power, and wood industries. On Wednesday morning there will be sessions devoted to cold-working of metals, central power station problems, and textiles. Visits to industrial establishments on Tuesday and Wednesday afternoons will include the Narragansett Electric Lighting Co., Brown & Sharpe Mfg. Co., the Providence Gas Co., and some selected textile and rubber plants. On Thursday, the visiting engineers will visit the Newport Torpedo Station, where they will have an unusual opportunity of seeing the launching of torpedoes. This visit will include an inspection of the shops, the training station, and the old battleship *Constellation*. Luther D. Burlingame, of the Brown & Sharpe Mfg. Co., is chairman of the executive committee in charge of the meeting. A very attractive social program with entertainments for the visiting ladies has also been planned in conjunction with the meeting.

The Manufacturer and the Metric System

AUTOMOBILE INDUSTRY OPPOSES METRIC SYSTEM

The directors of the National Automobile Chamber of Commerce announce that they have voted to oppose the bill introduced by Congressman Britten of Illinois, and any similar legislation having for its purpose the compulsory use of the metric system in the United System. In making this announcement, the National Automobile Chamber of Commerce points out that the present bill differs from previous bills relating to the compulsory use of the metric system in exempting manufacturing processes and tools designated in terms of any other system of weights and measures, providing mainly that from and after January 1, 1935, metric weights and measures shall be used for the buying or selling of goods, in the charging or collecting of transportation charges, and in the collection of postage, excises, and duties and customs charged by weight or measure by the Government of the United States.

The Automobile Chamber of Commerce takes the stand that as the use of the metric system is already permissible, it is felt that the enacting of compulsory legislation would lead to serious confusion without accomplishing any useful purpose.

* * *

A MACHINE TOOL BUILDER'S OPINION

By JAMES N. HEALD

Treasurer and General Manager, Heald Machine Co., Worcester, Mass.

The statement in March MACHINERY that the question of adopting the metric system should be settled by engineers is very pertinent. The writer has ideas that he imagines are peculiarly his own with regard to this matter, and possibly he approaches the problem from a somewhat different point of view.

The advocates of the metric system have a great deal to say about its advantages, but, as I understand it, the only things that it is proposed to change are the units of measurements for lengths, areas, contents, and weights. Why not also change the measurement for angles and time? Why not have 100 degrees to a circle, 100 minutes to a degree, and 100 seconds to a minute? In regard to time, why shouldn't we have 10 hours to a day, 100 minutes to an hour, and 100 seconds to a minute? That really would be an advantage, especially in cost keeping, as now in a great many plants, the hour is divided into tenths on the time clock, to simplify the figuring in the cost department.

And when we have made these changes, why not have 13 months to the year, each one of 28 days; then, the first of the month would always come on the same day, and the odd day in the year would be New Year's Day. When all these things have been worked into one perfect system, we will be willing to change over to it and live happily ever after.

Of course, all of our handbooks must be made over, because we will not have any more things like 33,000 foot-pounds equal to a horsepower. All of the formulas in handbooks that engineers and draftsmen frequently use will have to be changed, and this will make work for the printers and publishers of books.

* * *

OPINIONS OF A USER OF THE SYSTEM

By THEODORE H. MILLER

Works Manager, DeLaval Separator Co., Poughkeepsie, N. Y.

I have read the editorial "The Metric Bill Again" on page 540 of March MACHINERY. A few moments' reflection, I believe, will convince thoughtful men of the impossibility of making any progress toward the elimination of our chaotic system of weights and measures by leaving it to the manufacturers to make the change. It will be readily appreciated that we would not now be enjoying the great benefits of the decimal monetary system, except for the fact that it was made the sole standard and compulsory. A great many objectors to the metric system hold up the proposed compulsion as a sufficient reason for objecting to the decimal system, knowing full well that however meritorious it may be, it can never be applied unless it is made the sole standard, just as the money system is. It should also be borne in mind that practically all of those who object to the metric system have had no practical experience with it, and have never worked with it as a manufacturing proposition.

The great cost of the change to the metric system has been proved by the experience of those who have adopted it, to be overstated. My own experience in a large plant, covering a period of fifteen years, enables me to say, unequivocally, that the cost of the change in any machinery producing establishment will be more than paid for in the very first year of operation. The trouble is that many manufacturers have been persuaded to believe that in order to make the change, it would be necessary to throw away all drawings, patterns, jigs, fixtures, and small tools. Some even go so far as to say that it would be necessary to scrap machine tools. The real facts in the matter are that the size of nothing whatever need be changed. The sizes are merely called by another name or expressed in another unit.

Furthermore, it should be borne in mind that most manufacturers already are offering tools and machinery with metric dials and metric sizes, and these must be made, even though it be in small quantities, in addition to the English sizes. The adoption of the metric system would obviate that difficulty and expense entirely.

By a strange coincidence, in the same number of MACHINERY I find on page 532 a letter from Albert Guth proposing that, since tables of decimal equivalents are not always stamped on micrometer frames and are not always available to the mechanic, a brass or other plate be attached to all machine tools for ready reference, because with the English system it is necessary to have these tables—no one can carry the figures in his head. It may be readily seen that with the metric system, all such tables would be unnecessary, and, what is of vastly greater importance, the constant reference to such tables by all mechanics would be entirely done away with and time saved; because with the decimal system no conversions are required.

If the opinions expressed and the testimony furnished in regard to the metric system could be confined to people who have had actual experience with it, the problem would be very simple. I have just read that the railroads have testified before the Committee on Coinage, Weights and Measures that it would take more than $200,000,000 to make the necessary changes in the machinery of the railroads, if the metric system were adopted. As one who has operated a large machine shop for years under the metric system, I can say that none of the machinery would need to be changed, nor would there be any benefit whatever obtained by changing it. Let us once and for all recognize the fact that the statement very often made that all patterns, jigs, and machinery must be scrapped if we are to use the decimal system, is erroneous.

One of my acquaintances, in speaking of a certain engineer, remarked, "A man who can do a job is worth ten who cannot"; and so I think that the testimony of persons who have actually made the change to the metric system and used it in shop work for years, is worth any amount of testimony of those who have merely personal opinions, but who have had no experience with the changing over from one system to the other.

MILLING MACHINE OF UNUSUAL SIZE

A four-head, adjustable-rail milling machine, built by the Ingersoll Milling Machine Co., Rockford, Ill., for its own use, is shown in Fig. 1. This machine is of unusually large proportions, having a capacity for milling castings 10 feet wide, 8 feet high, and 36 feet long. The height of the machine is 17 feet 6 inches over-all; the bed is 64 feet long; and the table is 38 feet long and 104 inches wide, sliding on ways 14 inches wide. The total weight of the machine is 150 tons. spindles are 7 inches in diameter at the largest diameter of the taper, the quills being 11 inches in diameter. The driving motor is 100 horsepower, and the feed motor, 30 horsepower. All gears are of forged steel, hardened, and run in oil.

The table is provided with twelve changes of feed, the cutting feeds ranging from 1 inch to 24 inches per minute, while the rapid traverse is 15 feet per minute. The control provided permits the table to be rapidly traversed within 1/8 inch of the cutters, without any risk of running into them. The rapid traverse can also be thrown in between two cuts, so that the table moves forward rapidly between intermittent cuts. All feeds and rapid traverse are arranged for power operation, as well as hand adjustment.

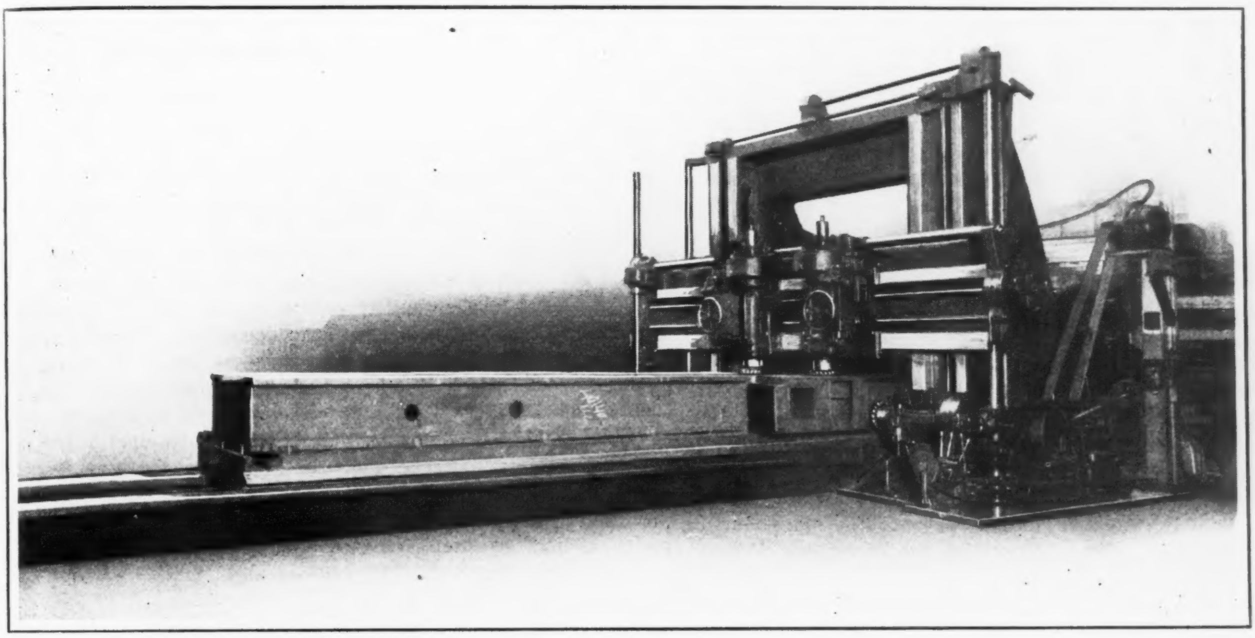


Fig. 1. Ingersoll Milling Machine having a Capacity for milling Castings 10 Feet Wide, 8 Feet High, and 36 Feet Long

The machine is provided with four heads, two on the cross-rail and one on each side, so that three sides of a casting may be milled simultaneously. When all four heads are at work, the machine has a capacity for removing up to 175 cubic inches of metal per minute, with cuts up to 1 inch deep in steel and proportionately deeper in cast iron. The rail upon which the two vertical heads are mounted is 21 feet 6 inches long; it has a face height of 38 inches, and weighs 15 tons without the saddles. The rail can be adjusted to any height within 8 inches above the table, so that the cutters may be supported near the work, whatever the surface upon which they are working.

The heads have power feed and rapid traverse both on the housings and along the rail. The vertical heads can be operated in different directions at the same time. The saddles are of the two-speed type, with a ratio of 2 1/2 to 1, so that the proper speed may be obtained for each spindle when cutters of different sizes are used. Each vertical head weighs about 10,000 pounds, and each horizontal head, about 7000 pounds.

The horizontal heads have a 20-inch quill adjustment, and the vertical heads have a 24-inch quill adjustment by power, as well as by hand. The

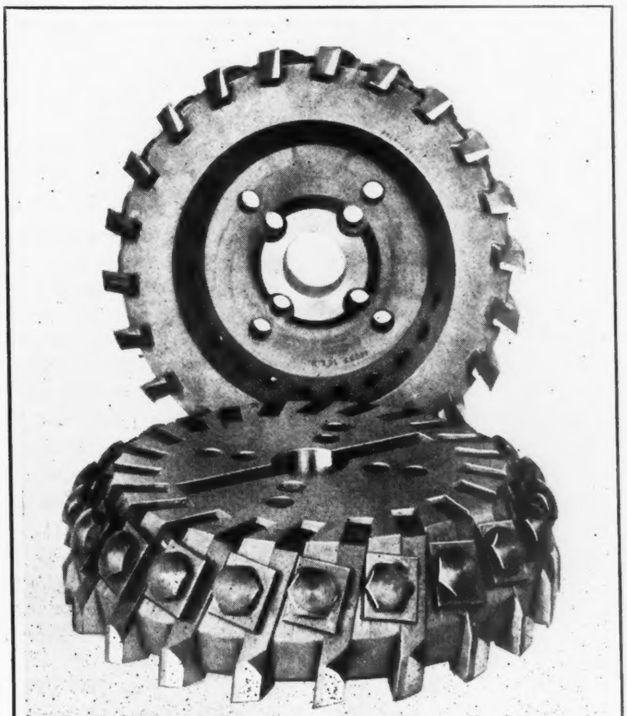


Fig. 2. Twenty-two-inch Heavy-duty Milling Cutters used on the Machine shown in Fig. 1

The casting shown on the table of the machine in the illustration is a bed for another Ingersoll milling machine; this bed casting is 36 feet long and weighs somewhat over 20 tons.

Recently an interesting experiment was carried out on this machine. Several castings were piled upon it until the total load on the table reached over 60 tons. With this load, the table was easily moved with the rapid traverse, and the operator was able to move the table, by using the rapid traverse, as little as 0.015 inch at a time.

Special cutters were developed with the view of enabling the full power of this machine to be used. These cutters are shown in Fig. 2, and are adapted for work on this and other modern high-power milling machines. They are 22 inches in diameter, and on roughing cuts are capable of removing fully 1 inch of stock from cast iron or steel. The teeth are made from 3/4- by 1 1/2-inch stock and are set in a hardened body or housing. They are ground with a 1 1/4-inch cutting edge, so as to permit cuts over 1 inch deep to be taken.

The Machine-building Industries

WHILE it is believed by many that the peak of the present production cycle has been passed and that there will be a gradual reduction in the volume of business, the Federal Reserve Board's latest report on production in the important basic industries hardly warrants any serious apprehension. The last month for which complete figures are available is January. During that month, the output of iron and steel, the basic supply in the machine-building industries, and of copper and zinc, increased. The decrease in the activity of the textile and petroleum industries made the total production in the basic industries listed 1 per cent lower in January than in December.

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Leading financiers have warned against the danger of a psychological recession in business. Some people have accepted the business cycle theory as being almost a natural law, like the law of gravity, and pin so much faith on it that they sometimes fail to take advantage of unusually promising business opportunities. The business cycle is an established fact, but the underlying causes for the cycle are within the control of the human mind rather than influenced by any unchangeable economic law. A prominent banker once said that the cycle consisted of four periods—hope, confidence, doubt, and fear. There is a great deal of truth in this statement, and the more thoroughly its significance is appreciated by leading business men, the less pronounced will be the valleys and peaks of business and the more nearly level will the business cycle curve become.

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During the last four years, the railroads have spent, on an average, $750,000,000 annually on new facilities of all kinds. While probably too small a proportion of this sum was spent for railroad shop machinery and equipment, it is worthy of note that the railroads have equipped themselves in a satisfactory manner with modern locomotives and freight cars. The railroads have been able to handle a very large volume of freight with unusual dispatch, having approximately 250,000 surplus cars in good repair and immediately available for service. The loadings of revenue freight for the first two months of the year showed an increase over the corresponding period last year, as well as over 1924.

New Machinery and Tools

The Complete Monthly Record of New Metal-working Machinery

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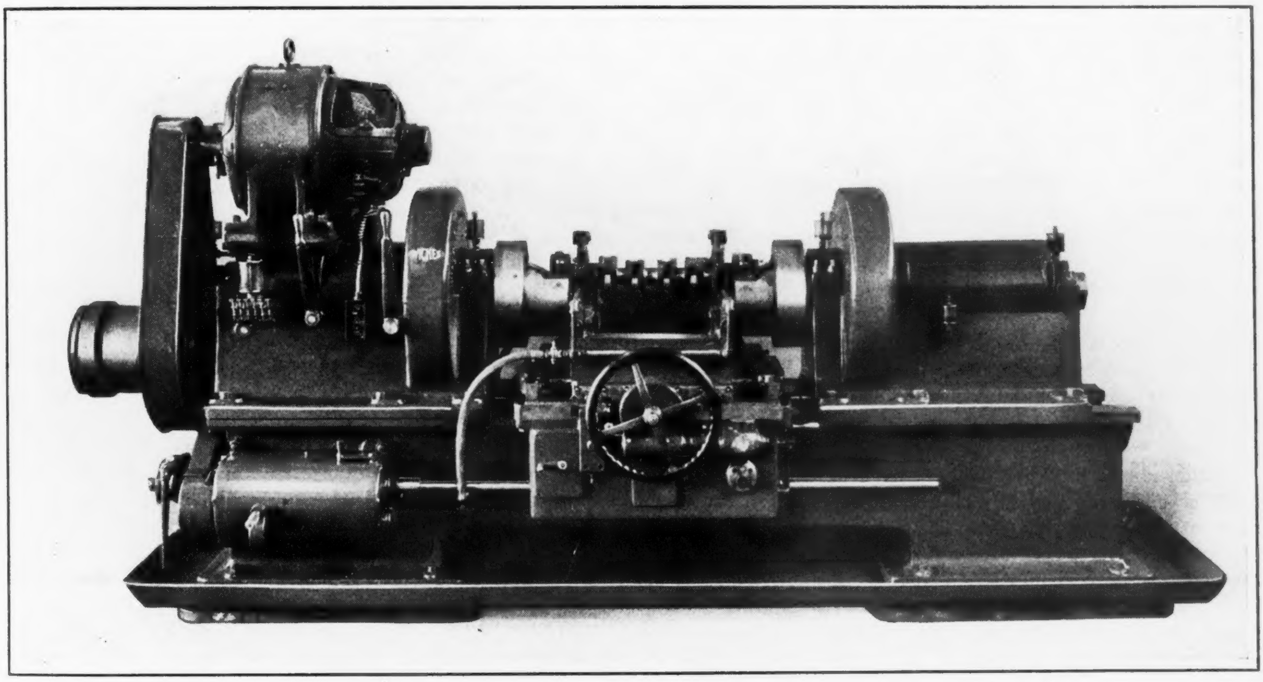
Power for the main drive is delivered by a 15-horsepower motor through a silent chain belt to a large sprocket at the left-hand end of the headstock; however, a belt drive from a countershaft can also be arranged for. From the main drive, power is transmitted through another chain to the feed-box and by direct gearing to a pump. The headstock is provided with a lever that operates a clutch and brake for driving and stopping the spindles, respectively. Two speed changes are obtainable in the headstock through gears shifted by another lever. The position of the rear headstock can be changed along the bed to accomodate crankshafts of different lengths. Lubrication of all bearings in the headstock is arranged for through sight-feed oilers located at a central point.

The spindles are made of high-carbon steel forgings with the faceplates or flanges integral. The spindle journals are ground to size, and run in bronze bearings lined with an anti-friction alloy. The front and rear spindles are driven together by herringbone gears and a heavy shaft which runs through the center of the bed. A herringbone pinion which drives the face gear of the rear spindle is adjustable on the driving shaft for aligning pot chucks and taking up any lag that may occur.

Eight feeds are obtainable through the quick-change gear-box. The carriage is of heavy construction and ribbed to prevent any deflection under heavy service that might cause the tools to chatter. A large opening in the center of the carriage permits chips to fall through during the operation. Guards prevent chips or coolant from coming in contact with the bearing surfaces of the carriage.

Divided cross-slides provide for feeding the front and rear tools toward the center of the machine simultaneously. The rear cross-slide is made the full width of the carriage, and has wings on each side which extend toward the front of the carriage and make it practically 3 feet square. The reason the rear cross-slide has been made of such proportions is because the pressure on the rear tool bits is upward. It is furnished with taper gibs on both sides and in the center. The front cross-slide fits between the wings of the rear slide, and is also gibbed in the center. Lubrication of these members is accomplished through "Alemite" grease cups.



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The cross-feed screw has right- and left-hand threads for feeding the front and rear slides simultaneously toward the center of the machine. The drive to the cross-feed screw is through a large worm-wheel mounted on the front end. A one-horsepower motor for rapidly traversing the cross-slides is connected by gearing to the rear end of the cross-feed screw, and a controller for this motor is mounted on the apron. When it is desired to bring the tools into the cutting position, this is accomplished in a few seconds by simply moving the controller handle. After the tool bits have finished machining the crankpins, the cross-traverse motor automatically withdraws the cutting tools from the center of the machine to permit reloading the work. The tool-blocks are made of cast steel, and the tool bits of heat-treated high-carbon steel.

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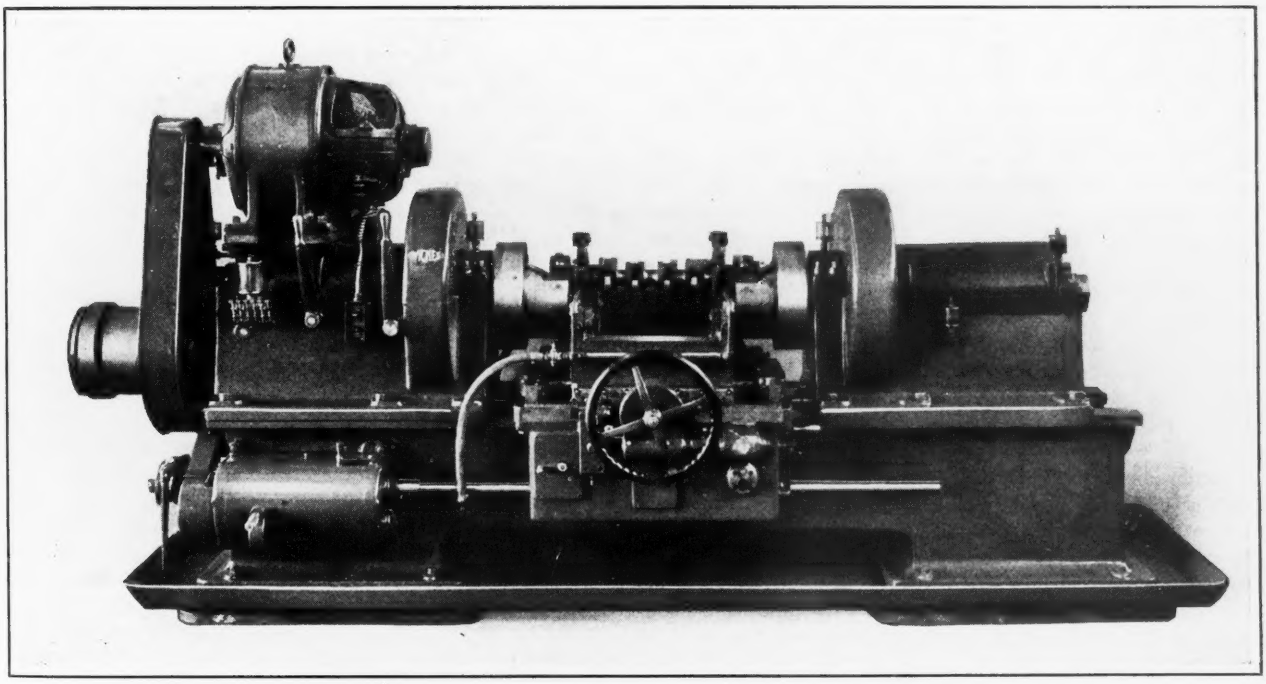

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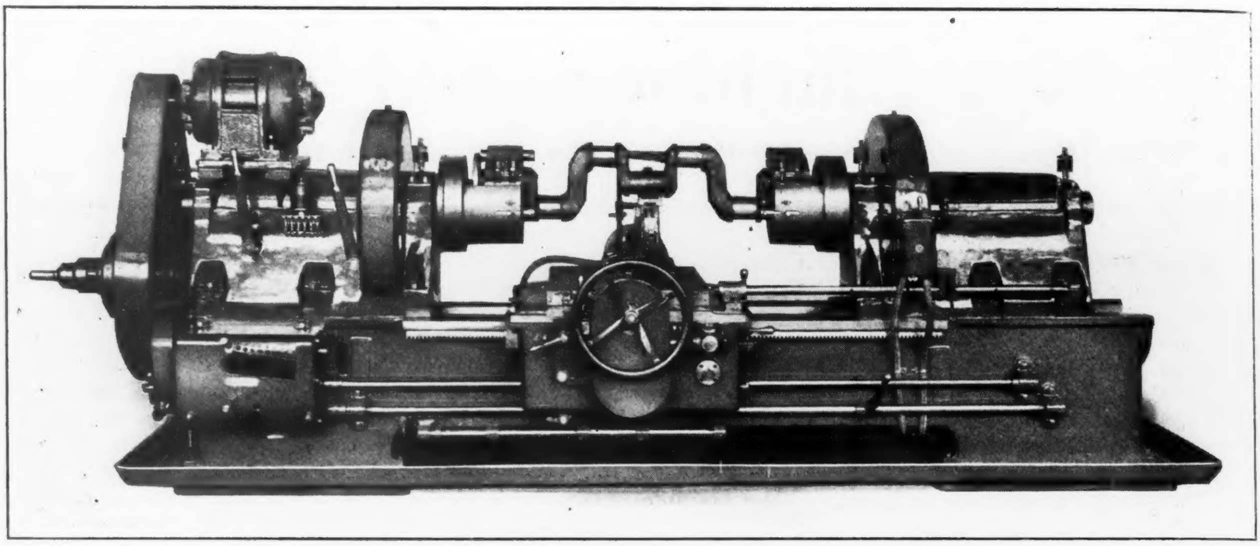


Fig. 2. Universal Crankshaft Lathe designed for finishing One Pin at a Time

from 4 to 6 inches. To facilitate loading and unloading the work, the caps on the pot chucks are of the quick-opening type. The front and rear bearings of the crankshaft are held in hardened steel bushings in the pot chucks. It will be seen from Fig. 3 that the pot chucks may be extended to permit clamping the crankshaft close to the pins being machined, and thus remove any possibility of distorting the work. Fig. 3 shows a machine taking cuts on pins Nos. 4 and 5 of a crankshaft. The rapid traverse of the cross-slides and the method of setting the pot chucks to suit the stroke of the crankshafts are patented.

A number of automatic features have been incorporated in the design of the lathe to save time and effort on the part of the operator. When crankshafts having long cheeks are being machined, the lathe should be provided with a direct-current motor having the speed adjustable by means of a field control. Then an automatic accelerating device can be provided which causes the lathe spindle to revolve slowly as the tool bits begin to machine the outside diameter of the cheeks and then to increase the spindle speed as the tool bits move down the cheek and the surface being cut becomes smaller in diameter. Thus a constant cutting speed is maintained.

Another important feature is an automatic split feed, which actuates the tool bits at a coarse feed when the tools start cutting the cheeks, and decreases this feed as the tool bits move down toward the pin where the cheeks become heavier and the tool bits begin to turn the entire length of the pin as well as the fillet. As soon as the pins have been turned to the proper diameter, an automatic diameter stop trips the feed. The spindles then continue to revolve six revolutions in order that the tool bits may turn the pins to a true circle, after which the spindles and the flow of coolant are automatically stopped. The cross rapid traverse motor then automatically returns the cross-slides to the reloading position.

In addition to the features of the duplex lathe, the universal lathe has a power longitudinal feed, automatic longitudinal stops, and a positive longitudinal locating bar for positioning the carriage in the correct location for machining the fillets of the pins. Fig. 4 shows the carriage of a universal lathe in position for machining pin No. 4 of a heavy crankshaft. The swing over the bed of both these machines is 34 inches, and over the cross-slide, 20 7/8 inches. The standard length of bed is 11 feet, and the weight of a machine with a standard length bed, approximately 14,500 pounds.

OLSEN TESTING EQUIPMENT

An automatic and autographic universal testing machine constitutes one of the latest developments of the Tinius Olsen Testing Machine Co., 500 N. 12th St., Philadelphia, Pa. This machine is illustrated in Fig. 1. The straining system is of the Olsen standard three-screw type used in previous machines, but the drive of the straining system is new in design. By means of the four hand-levers shown, eight positive speed changes can be obtained in either direction, as shown on an instruction plate attached to the machine. The cross-head can be raised or lowered instantaneously by operating the hand-lever at the extreme left, while by shifting the three remaining levers slightly, speeds of 0.05, 0.1, 0.2, 0.4, 1, and 2 inches per minute are obtainable for testing to the full capacity, and speeds of 4 and 8 inches per minute are obtain-

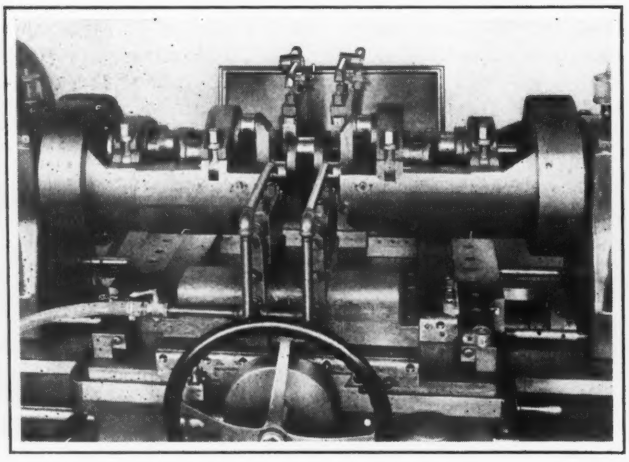


Fig. 3. Duplex Lathe engaged in turning Pins Nos. 4 and 5 of a Crankshaft

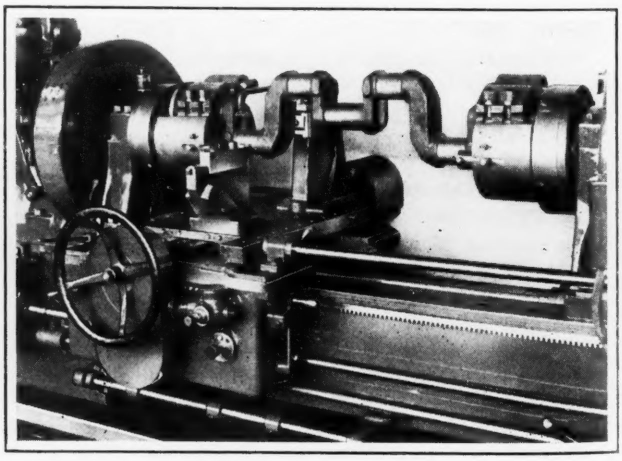


Fig. 4. Turning Pin No. 4 of a Heavy Crankshaft in the Universal Type of Lathe

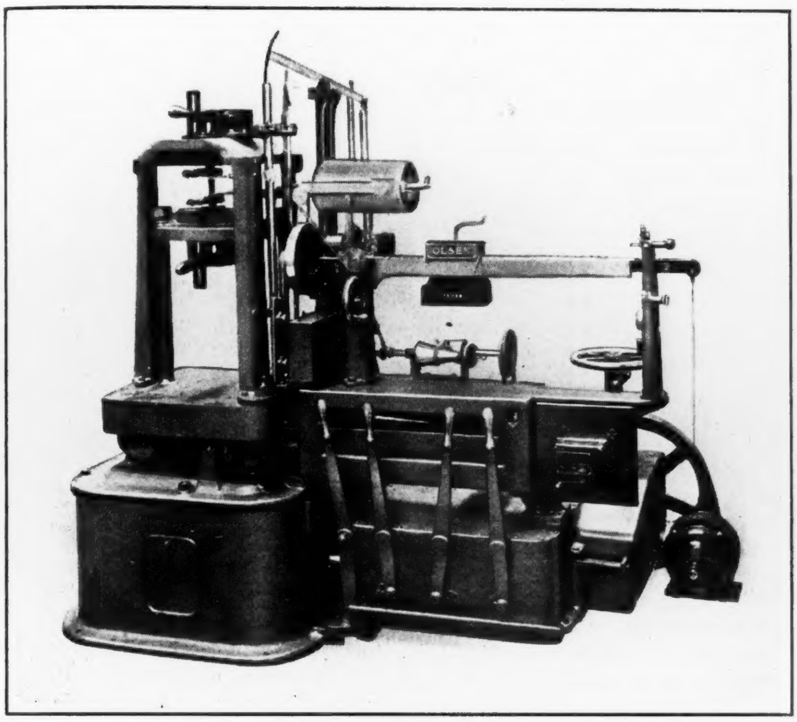


Fig. 1. Olsen Automatic and Autographic Universal Testing Machine

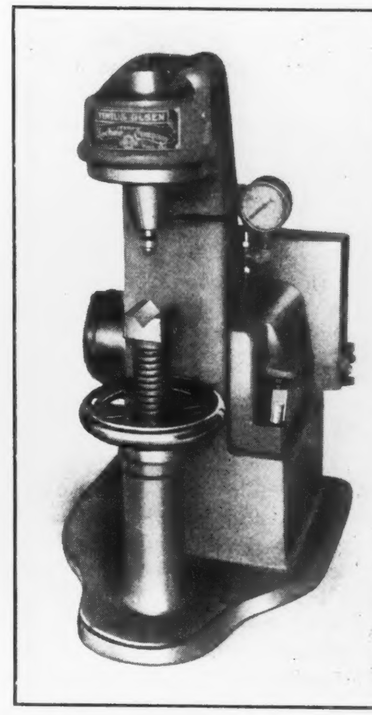


Fig. 2. Motor-driven Brinell Hardness Tester

able for applying light loads and for adjusting the cross-head. It is also found advisable to have a hand adjustment, and this is provided by operating the horizontal handwheel seen on top of the lever housing. This hand-adjusting mechanism may be used after raising a small hand-lever, and will act in conjunction with any of the eight gear-speed ratios. The hand mechanism is automatically thrown out of engagement when the power drive is applied. All gearing can be placed in a neutral position to make it impossible to lock the gears or cause damage during the shifting of the levers.

The machine is operated by a constant-speed motor and a silent chain drive. The weighing system is the Olsen standard lever type. Three poises are provided for the scale beam, so that autographic records can be obtained of tensile, compressive, or transverse stresses. This is accomplished without the use of a yoke mechanism and at any point in the travel of the cross-head up to the rupture point of the specimen. Elongation or compression is magnified ten times. A chart 10 by 20 inches in size is used. The autograph attachment may be used with an automatically or manually operated beam. When the machine is equipped with a dial vernier screw beam, the poise is actuated by means of a handwheel to weigh the load. The eight-speed reversing gear-box drive can be furnished with any Olsen four-screw type of universal testing machine of the same capacity.

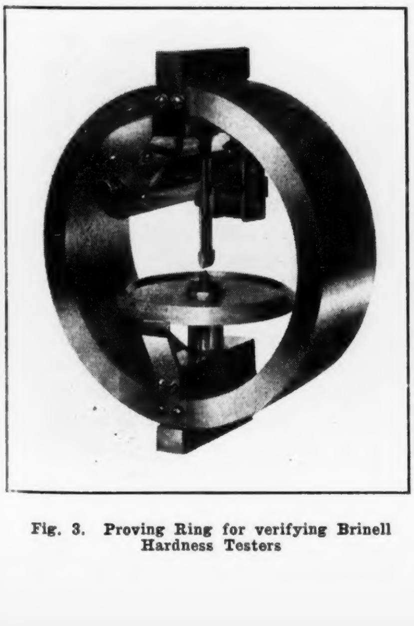


Fig. 3. Proving Ring for verifying Brinell Hardness Testers

Another recent development of the same company is the motor-driven hydraulic Brinell hardness tester, shown in Fig. 2, which is made in two sizes. The Brinell hardness load of 3000 kilograms is applied and removed without any effort, and almost instantaneously, by operating the small knurled-head screw at the right, after the specimen has been clamped by means of the handwheel. The pressure may be maintained momentarily or as long as desired. The load is automatically controlled so as to prevent either underloading or overloading, and can be readily adjusted for calibration. The progress of the test is indicated to the operator by the gage. A motor of the necessary fractional horsepower is supplied to suit requirements.

The claim made for this machine is that an operator can test parts throughout the day without fatigue and thus secure a maximum production. To facilitate obtaining the Brinell hardness numbers, an illuminated microscope is supplied, and when desired, the machine can be equipped with a direct-reading floating type of depth measuring instrument. The No. 1 type of machine has a gap of 4 inches, and is adapted for testing parts up to 7 inches in diameter. It weighs about 300 pounds. The No. 2 type has a gap of 7 1/2 inches, and is adapted for testing parts up to 15 inches in diameter. This size weighs about 600 pounds.

Fig. 3 shows a proving ring for accurately and quickly verifying Brinell hardness testers. Distortion of this ring may be measured by means of a micrometer screw in conjunction with an electrically operated vibrating reed contact.

Fig. 4. Ductility Testing Machine with Motor Drive

Each apparatus is calibrated by U. S. standard weights. This verifying ring is supported on the adjustable anvil of the hardness tester to be calibrated, with the recess in the top plate of the ring placed directly beneath the ball. A zero reading is then taken, after which the adjusting screw of the tester is elevated to bring the recess of the ring into contact with the ball and into accurate alignment with its line of action. The load is next applied, and the reading taken for deflection, which when corrected for the zero reading and compared with the calibration chart, gives the load on the verifying ring.

Hand-operated and motor-driven improved No. 2A ductility testing machines for determining the drawing qualities of sheet metal have also been brought out by this company. The motor-driven equipment is illustrated in Fig. 4. These machines are provided with the Olsen strain gage pressure weighing system. The sheet metal is clamped under a die, with a clearance left for drawing purposes. A cupping tool is then forced into the metal, and the depth of cup and pressure required to rupture the metal are read directly from the two dials. The depth of cup is indicated on the upper dial, which registers in thousandths of an inch, while the pressure is indicated by the lower dial in amounts up to 12,000 pounds. The standard machine will handle sheet metal up to a thickness of 1/16 inch.

When a motor-driven equipment is used, a more uniform application of the cupping and of the load is obtainable. Such a machine gives the operator ample time to note the readings during the test, and by reducing the manual effort to a minimum, speeds up the tests. In operating the motor-driven machine, the specimen is inserted the same as in the hand-operated machine, after which the clutch lever is operated to engage the power mechanism. The test continues until fracture occurs, as indicated by the drop of the pointer on the pressure dial, at which time the pressure reading is taken. The clutch lever is then reversed, the depth of cup read, and the cupping mechanism quickly returned to the starting point by turning the vertical handwheel. Power for driving the machine may be taken from any lighting circuit.

PFAUTER GEAR-HOBBING MACHINE

A Pfauter No. 4 automatic gear-hobbing machine for producing spur, helical, and worm gears has been placed on the market by the O. Zernickow Co., 21 Park Row, New York City. One of the important features of this machine is a hydraulic system which counteracts the weight of heavy work and three-fifths of the table weight, so as to assure smooth operation of the table with a minimum consumption of power. This is accomplished by means of a pump which forces oil between the circular bearing surface of the table and the corresponding surface of the carriage, in an amount proportional to the load. Accurate control of this hydraulic system is made possible through a pressure gage.

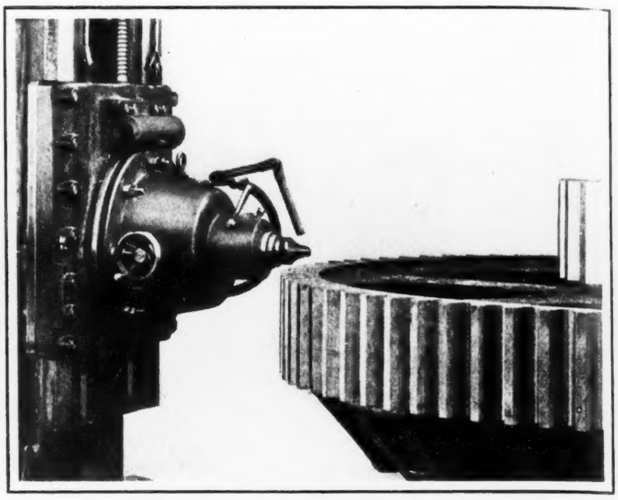


Fig. 2. Cutting Large Spur Gear with the End-mill Cutter-head

Another feature of the machine is the construction of the cutter-head, which may be clearly seen in Fig. 1. The members in which the cutter-arbor is mounted are attached to surfaces on the main cutter-head casting that are on the same plane as the center of the arbor. The cutter-head may be accurately swiveled into any angular setting, and the hob-spindle bearing may be adjusted sideways for centering the hob. A scale and vernier provide for accuracy in making this adjustment. Centering of a hob tooth is accomplished by means of a special device.

The hob-spindle carriage is made long, with a short overhang of the hob, so as to permit heavy cuts to be taken without chattering of the cutter. This carriage slides on double V-shaped ways equipped with gibs that are adjustable to take up play. A counterweight within the upright balances the carriage and cutter-head. There is a rapid power traverse in both directions for the cutter-head and table carriages, and this traverse is actuated by shifting a lever on the change-gear side of the machine. The index worm-wheel is of large diameter, and located close under the work-table. The index worm is adjustable to take up wear between itself and the wheel. The hob arbor and table are driven in conjunction and in a positive ratio relative to each other, thus giving an automatic indexing process. It is claimed that the maximum error from tooth to tooth in a gear 40 inches in diameter is 0.0004 inch. The arbor support can be swiveled and turned out of the way, and the arm is adjustable vertically.

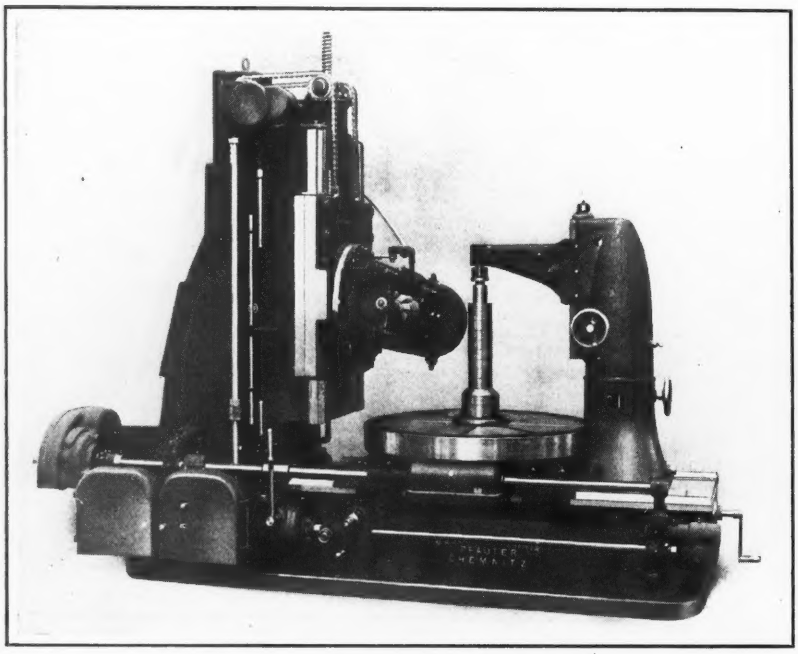


Fig. 1. Pfauter Automatic Gear-hobbing Machine

The automatic feed is controlled through gears which move the cutter-head vertically or the table against the hob. The amount of feed is not limited by fixed ratios, and any feed can be selected to suit the nature of the work and the tool used. The feed can be stopped automatically or by hand. Spur and spiral gears are cut with the vertical feed to the cutter-head and with the table base stationary. Worm-gears for single-thread worms of small lead are cut with the table feeding in toward the hob and with the cutter-head stationary, while gears intended to mesh with multiple worms of large lead are hobbed by means of a cross-feed cutter-head, which gives the hob a tangential feed. Taper hobs or fly cutters are used in the latter case.

Another feature of the machine is the differential gearing, which is located inside the bed with only the lead gears on the out-

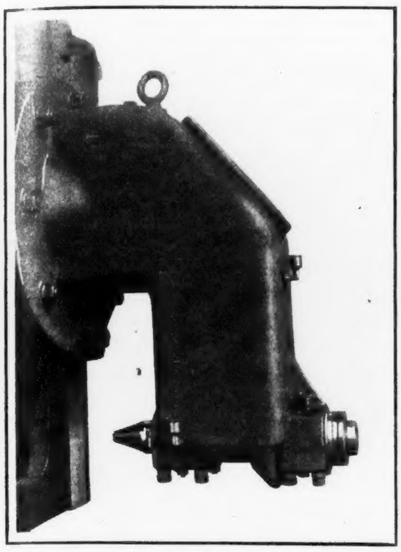


Fig. 3. Internal Gear Cutting Attachment

side. This differential is used mainly in cutting spiral gears automatically, and gives an additional motion to the table according to the helix angle of the teeth. The lead gears of the differential are independent of the indexing and feed gears. When a cut is finished, the automatic stop of the feeding mechanism also disengages the differential drive. In hobbing worm-gears with the cross-feed cutter-head, the differential gearing gives an additional movement to the table according to the amount of cross-feed per revolution of the worm-gear, and in cutting herringbone gears with an end-mill cutter-head, the differential gearing is used the same as in hobbing helical gears.

In Fig. 2 is shown an attachment that may be mounted on the cutter-head saddle for cutting gear teeth that are beyond the hobbing capacity of the machine. It will be seen that the tool is an end-mill of a shape that suits the contour of the teeth to be cut. When solid herringbone gears are to be machined by this method, a reversing mechanism is provided. Fig. 3 shows an attachment used for cutting internal gears with end-mills, and a similar attachment is made in which single gear-cutters are used. The machine has a capacity for spur gears up to 87 inches in diameter, 23 inches face width, and 1 1/4 diametral pitch. The weight of the machine is about 21,200 pounds.

COPPER-TUNGSTEN WELDING ELECTRODES

Copper-tungsten electrodes, which are expected to prove of great value in the fabrication of metals, are now available for use in manufacturing. This announcement is made by the General Electric Co., Schenectady, N. Y., who developed the new electrode. One of the limiting features in many resistance or spot welding operations has been the copper electrode used, the pure copper not being hard enough when used under the high pressures at high currents common to this type of welding. Usually, after a few welds are made, the surface of the copper electrode in contact with the weld becomes hot enough to anneal the copper, thus making it very soft. As a result, the copper tip rolls and mushrooms over the edges, giving a large spot weld which changes the current density and, consequently, the quality of the weld.

Copper-tungsten, as its name indicates, is a mixture of two metals—one a good electrical conductor and the other very hard. The alloy has a hardness of 225, Brinell, as compared with 82 for hard copper and 30 for soft copper. The compressive strength of the copper-tungsten is 208,000 pounds per square inch as against 58,000 pounds per square inch for hard copper. The tensile strength is 56,350 pounds per square inch, compared with 30,000 pounds for soft copper and 50,000 to 70,000 for hard drawn copper.

Copper-tungsten does not anneal at red heat. Thus there is no soft surface metal to roll or mushroom over when used in resistance welding. It has not been found necessary to form the entire electrode point or die of copper-tungsten, but rather to use only inserts of this alloy. The remainder of the die is made of copper as before.

In view of the higher first cost of copper-tungsten, its chief value is expected to be in special applications. It is particularly adapted for use under severe conditions where copper will not stand up. The durability of the new alloy is shown by a recent test, where the number of welds made with one dressing of a copper die averaged ten, while the first test using copper-tungsten inserts gave more than 1000 welds, and the die was still in good condition at the end of the test. Other tests showed even better results. It is therefore expected that the cost of changing the old copper electrodes and redressing them will more than pay for the larger first expenditure for copper-tungsten. The material has been given the trade name "Elkonite," and will be manufactured and sold exclusively by the Elkon Works, Inc., Weehawken, N. J., of P. R. Mallory & Co.

FELLOWS THREAD GENERATOR

The thread generator for taps, worms, hobs, and similar parts, built by the Fellows Gear Shaper Co., 78 River St., Springfield, Vt., and described in July, 1923, MACHINERY, has been redesigned. It is now provided with a reversing and quick-return mechanism, and several other important features, which not only increase the productive capacity of the machine, but also improve and simplify its operation. There have been no changes in the fundamental principle, but because of the improved design, this principle is applied in a more efficient manner.

Fig. 1 shows a front view of the new model, from which it will be seen that the driving mechanism is located at the right-hand end of the machine, and comprises a gear-box and two pulleys. The larger pulley operates the drive for cutting; the smaller pulley acts as an idler and, through the quick-return gear-box, furnishes the drive to return the cutter-slide to the starting position.

The machine is operated in the following manner: Assuming that the machine has been completely set up with the work and cutter in position, the operator pushes lever *A* from him (if a right-hand threaded worm is to be cut). This engages a clutch in the gear-box at the left-hand end of the machine. At the same time, the operator pushes lever *B* to the right to shift the belt on the tight pulley. The cutter then starts in operation on the work, provided the feed clutch has been engaged, and travels toward the left-hand end of the machine. When the cutter reaches the end of the

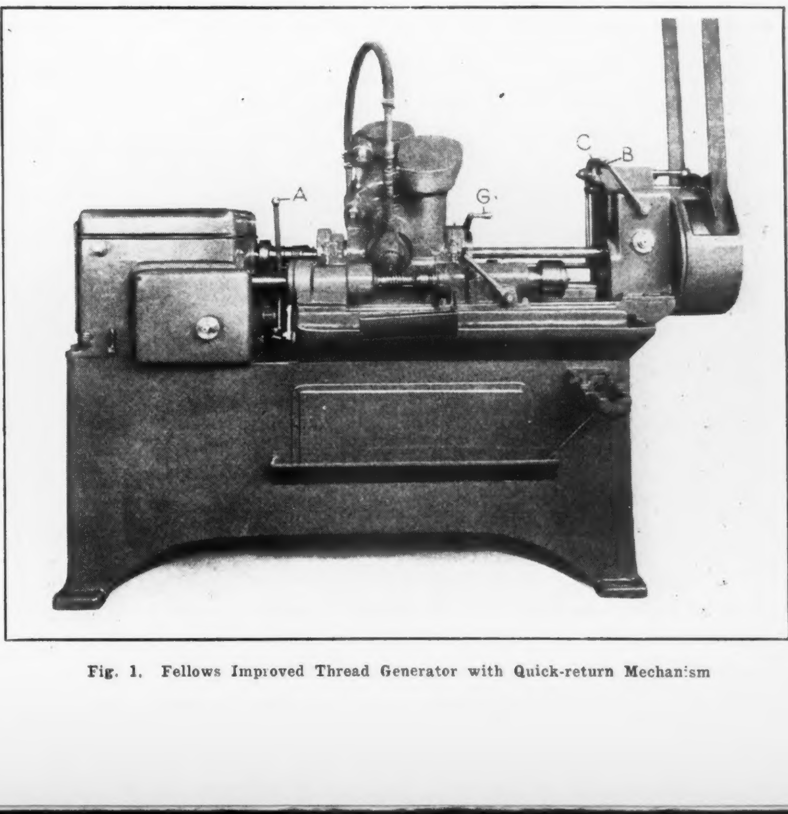


Fig. 1. Fellows Improved Thread Generator with Quick-return Mechanism

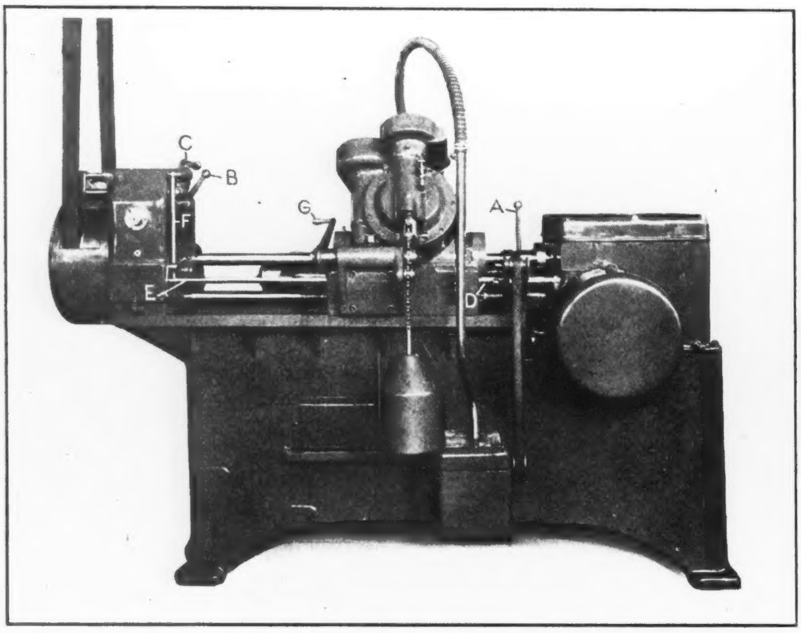


Fig. 2. Rear View of Fellows Thread Generator, showing the Arrangement of the Quick-return Mechanism

cut, the cutter-slide engages stop *D* on rod *E*, Fig. 2, moving the rod toward the head of the machine and lifting up the vertical rod *F*. The latter, in turn, operates trip-lever *C*, throwing the belt on the loose pulley and thus stopping the machine.

The operator then lifts lever *G* to raise the cutter from the work, removes the work, and engages the quick-return mechanism by pulling lever *A* toward him. The machine automatically stops when the cutter reaches the starting position, after which the operator inserts a new piece of work, pulls down lever *G* to bring the cutter to the cutting depth, and starts the machine as previously described.

The differential mechanism, which effects perfect harmony between the cutter and the work as the latter is fed longitudinally, has also been simplified, so that no changes are necessary in the mechanism itself, for cutting either right- or left-hand threads. All that is required is to change the position of a screw in the starting lever *A*, and remove or insert a split ring on the cutter-head, such as shown in Fig. 3. Helical gears have been substituted for spur gears in the drive to the work-spindle, in order to furnish a smoother drive. A clutch has also been added, so that the power feed can be engaged or disengaged at will; this has been found of considerable convenience in setting up the machine. This clutch is mounted on the shaft that operates the feed-gears which control the rate of travel of the cutter-slide along the bed.

Changes have also been made in the cutter-head control mechanism. On the original machine, a control bar mounted at the rear of the machine was so arranged as to enable the cutter to take roughing and finishing cuts at the same setting. For most work, it has been found that sufficient accuracy and smoothness of finish can be secured in a single cut. This mechanism has now been simplified, and three different types of controls can be applied. One of these types, shown in Fig. 2, is adapted for work on which the cutter can start at full depth. Other control mechanisms are used when the cutter must be fed to depth at the same time that it is being traversed. The worm adjustment for setting the cutter to the proper depth is still retained.

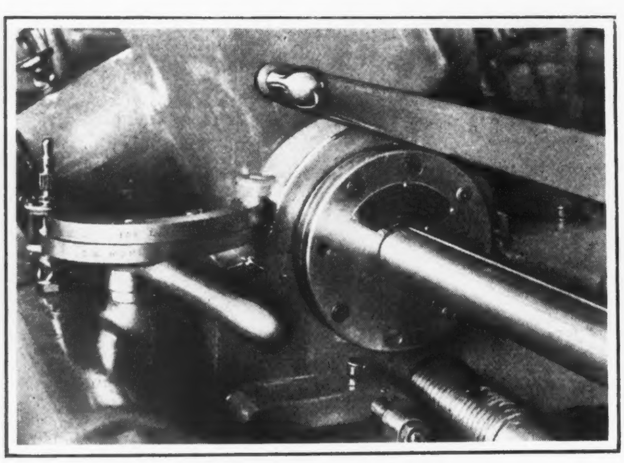
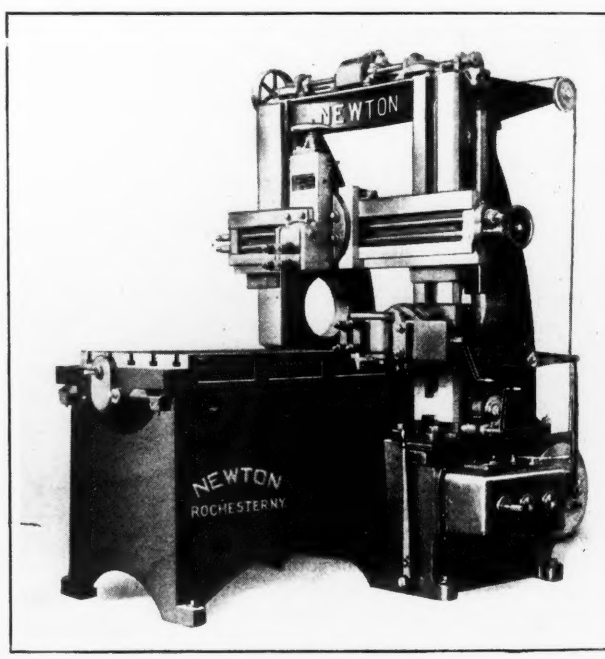


Fig. 3. Close-up View of the Cutter-head

The new generator can be arranged for either a belt or a motor drive. A simple method of mounting the motor is by means of a bracket fastened to the rear of the bed which carries a trunnion on which an additional bracket is held. The motor is fastened to the second bracket and the pulley on the motor lined up with the two pulleys on the machine. The tension of the belt is taken care of by means of an adjustable set-screw on the trunnioned bracket.

NEWTON SIDE-HEAD CRANK PLANER

A crank planer equipped with cross-rail and side-heads, which has recently been brought out by the Newton Works of the Consolidated Machine Tool Corporation of America, Rochester, N. Y., is shown in the accompanying illustration.



Newton Crank Planer with Cross-rail and Side-heads

This machine is built in two sizes one of which has a stroke of 34 inches, and the other, a stroke of 39 inches. There is a vertical power feed and a hand adjustment for the side-head, and the head may be lowered below the top of the table when desired. It has a relief tool apron with double clamps, and may be swiveled 45 degrees either side of the zero mark. It is counterbalanced to permit easy adjustment, by a weight carried at the rear of the machine. A side-head may be furnished for each upright.

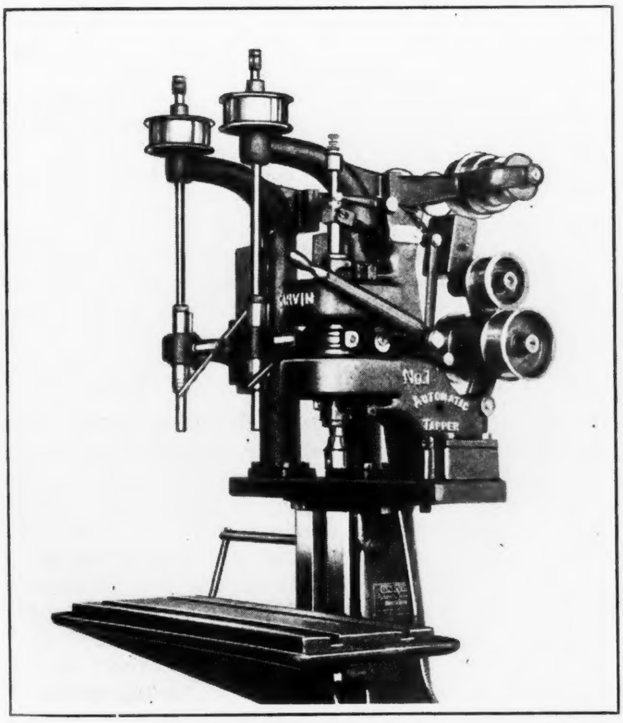
Adjustment of the table for positioning work may be accomplished while the machine is in operation. This is done through an adjustment block and screw, the block being securely clamped for the cutting operation. The stroke is adjusted from the operating side of the machine by means of a crank handle, an indicator giving the length of stroke in

inches. Six speeds are provided through a gear-box of the sliding gear type, for changing the number of table strokes per minute. The table is controlled by means of a clutch and brake, which permit "jogging" the table for tool setting, etc. The clutch may be locked so that the machine cannot be started with injury to the operator.

Adjustment of the cross-rail by power is through double lifting screws. The tool-slide on the vertical head has an equal movement above and below the bottom of the rail, thereby reducing overhang to a minimum, and may be swiveled 45 degrees either way. Power may be delivered by a 10-horsepower motor running at 1200 revolutions per minute or by a single pulley driving through a change-gear box.

GARVIN DRILLING AND TAPPING MACHINE

A machine equipped with two drill spindles and a Garvin No. 1 automatic tapping head, is shown in the accompanying illustration. This machine was recently built by the Western Machine Tool Works, Holland, Mich., and closely follows the design of the machine illustrated in March MACHINERY, with the exception that the previous machine

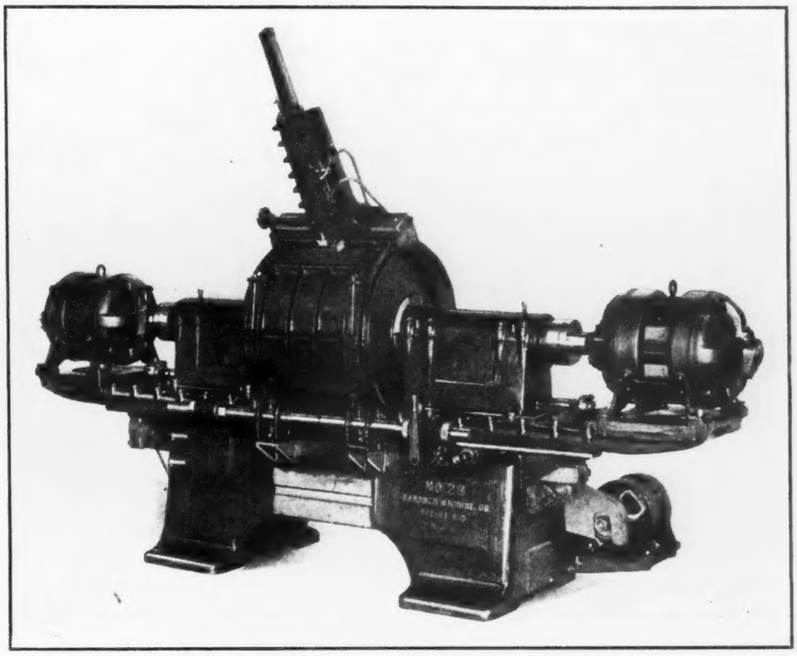


Garvin Machine with Two Drill Spindles and an Automatic Tapping Head

was equipped with two automatic tapping heads only. Machines of this design are also built with three automatic tapping heads, or two tapping heads and one drill head.

GARDNER OILGEAR-FEED DOUBLE-SPINDLE DISK GRINDER

In the accompanying illustration is shown a No. 28 heavy-duty Oilgear-feed double-spindle disk grinder which was designed by the Gardner Machine Co., 414 E. Gardner St., Beloit, Wis., to meet the requirements for a larger machine than the No. 27 described in September, 1925, MACHINERY. In general details of construction, the new machine is similar to the previous one, but it is more rigid, carries larger grinding members, and has a wider opening between the



Gardner Double-spindle Disk Grinder equipped with an Oilgear Feed for the Sliding Heads and Dressing Device

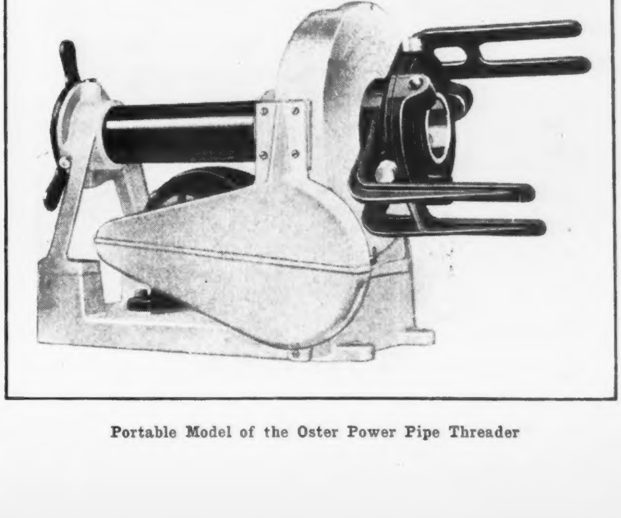
heads. It will handle work 50 per cent heavier than the No. 27 can accommodate. Timken adjustable bearings are provided for the spindles.

The grinding members consist either of 26-inch steel disk wheels mounted on reinforcing backing plates, or 24- by 6-inch ring wheels having any desired center opening. These wheels are held in suitable chucks. The hood enclosing the grinding members is made of cast steel to insure ample protection for the operator and to make the machine suitable for both wet and dry grinding. The sliding heads are operated longitudinally by a standard Oilgear feed, which will deliver a pressure up to 9000 pounds between the heads if necessary.

Adjusting screws permit independent adjustment of each head to compensate for uneven wheel wear. The wheel dressing device is also operated by the Oilgear mechanism, which gives a smooth steady feed with correspondingly improved results over a hand feed. On the front and rear of the base there is a finished pad to permit the application of power-operated cross-feed knees, without altering the base casting. Both legs of the base are hollow, and serve as water reservoirs in wet grinding operations. The machine occupies a floor space of 14 by 10 feet, and weighs approximately 8000 pounds.

OSTER PORTABLE PIPE THREADER

A lighter model of the power-driven pipe threader built by the Oster Mfg. Co., Cleveland, Ohio, is being introduced to the trade. The body of this machine is made almost entirely



Portable Model of the Oster Power Pipe Threader

of an aluminum alloy, which is not only stronger and more durable than the former cast-iron model, but much lighter in weight. It weighs only about 150 pounds, and constitutes a portable unit without removing any parts.

Power for the drive is furnished by a 1/2-horsepower universal reversible motor, which automatically speeds up for the smaller sizes of pipe and holds the necessary speed for the larger sizes. The motor can be run on a 110- or 115-volt lighting circuit, either direct or alternating current. The reversible feature makes it possible to use almost any die-stock with the machine.

The pipe is held stationary in a three-jaw self-centering chuck, while the pipe tools are turned by means of the driving arms. Self-centering universal guides in the rear of the machine assist the front chuck in centering long lengths of pipe. The machine itself will drive die-stocks and pipe cutters having a capacity up to 2 inches, and with a special auxiliary drive shaft, geared die-stocks and cutters having a capacity up to 6 inches can be driven. The machine may also be used to screw up fittings by putting a pipe wrench in the driving arms. It is 18 inches high, 14 1/2 inches wide, and 30 inches long.

CLEVELAND DOUBLE-END AUTOMATIC

Another model has been added to the line of automatic screw machines built by the Cleveland Automatic Machine Co., Cleveland, Ohio. This model J machine is intended for double-end operations, such as threading pipe nipples and studs, milling bearing diameters on both ends of shafts, or drilling and chamfering both ends of parts simultaneously. Departing from the usual custom of revolving the work while the tools remain stationary, this machine is arranged to rotate the tools and carry them to the work, which is held in a stationary center chuck. There are two sizes of this machine, one of which threads nipples up to the 3/4-inch pipe size and studs up to 3/4 inch in diameter, in lengths from 1 1/2 to 12 inches. The other size has a capacity for pipe nipples up to 2 inches and studs up to 1 1/2 inches in diameter, in lengths from 1 1/2 to 14 inches.

The machine is equipped in the center with a hopper magazine which is arranged with oscillating levers timed from the camshaft to control the dropping of the parts to sliding conveyor fingers. These fingers carry each piece to the air-operated floating center chuck. A mechanically operated chuck can be furnished when desired. In Fig. 2 the conveyor fingers are shown delivering a nipple blank to the chuck, while Fig. 1 shows a nipple blank in the chuck and the self-opening die-heads advancing.

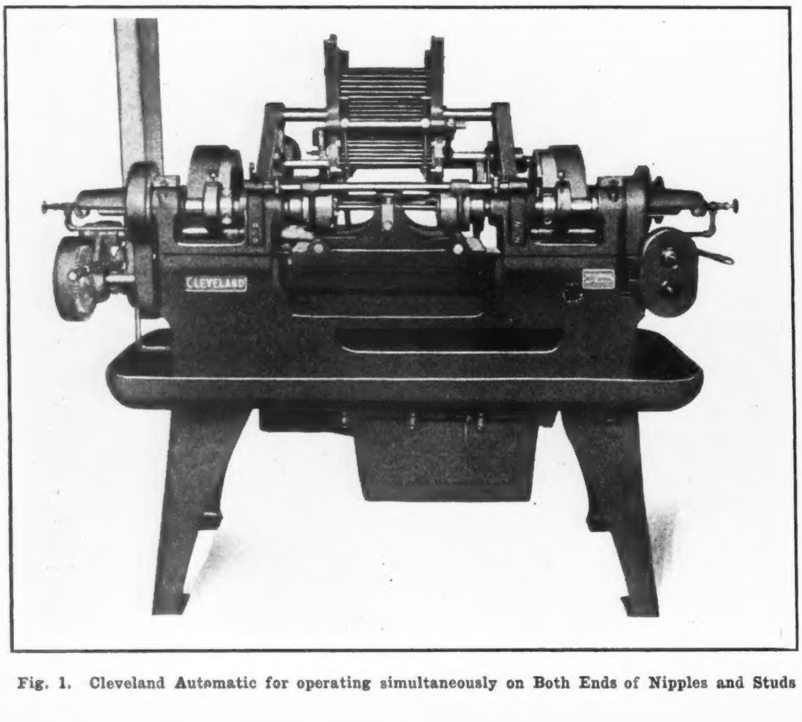


Fig. 1. Cleveland Automatic for operating simultaneously on Both Ends of Nipples and Studs

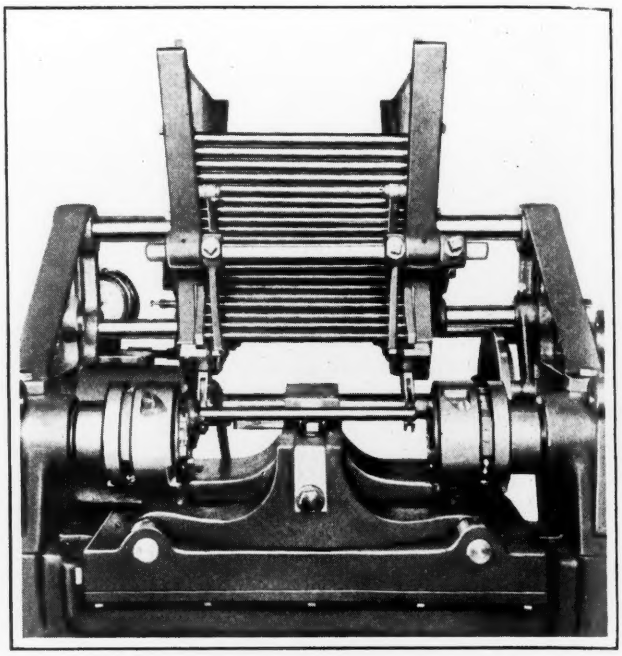


Fig. 2. Magazine and Work-conveyor Fingers

A single-pulley belt or motor drive may be furnished. The power is controlled through a clutch in the driving pulley which is operated by a hand-lever at the left-hand end of the machine. Engagement and disengagement of the tool feed are accomplished through a hand-lever on the extreme right. The machine may be turned over by hand by revolving a crank placed on the shaft to the left of the tool-feed hand-control lever. Damage to any part of the machine or tools in case of accidental jamming of the tools is prevented by a pin which shears and stops the feed if jamming occurs.

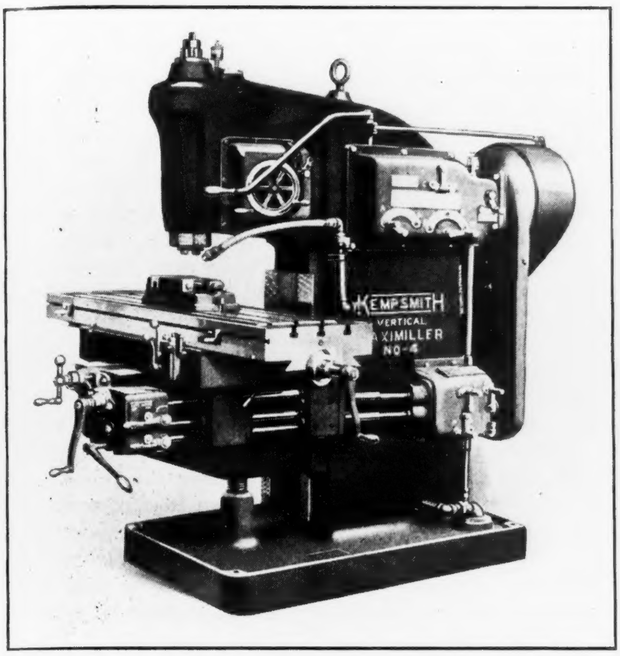
The feed to the two tool-spindles, the finger conveyors in the magazine, the lever which controls the feeding of parts to the conveyor fingers, and the opening and closing of the floating center chuck are all accomplished through the use of cams. Change-gears provide four spindle speeds. Oil is carried through the tool-spindles and the self-opening die-heads to wash away chips and lubricate the chasers.

KEMPSMITH VERTICAL MAXIMILLERS

Vertical Maximillers provided with an adjustable spindle designed particularly for die-sinking, toolmaking, jig-boring, and other work requiring an accurate and sensitive adjustment of the spindle are being placed on the market by the Kempsmith Mfg. Co., Milwaukee, Wis. All features of the standard Maximiller are retained in these machines, with the exception of the fixed spindle.

Power is delivered to the spindle through spiral-bevel gears and herringbone gears. The spindle is mounted in an octagon-shaped quill which gives a large bearing area and requires no gibs. There are two large bronze bearings in the quill. Ten splines on the upper end of the spindle are used to effect the drive. The spindle speeds are the same as on standard Maximillers, but speeds two and one half times the standard can be provided for a ball-bearing spindle. The spindle nose is of the design standard with this company.

There are three power feeds to the spindle of 0.005, 0.009, and 0.014 inch per revolution, respectively. The feed is through a screw driven by worm-gearing, and is reversible; a safety device prevents over-travel. There are two rates of hand feed, 0.025 and 0.125 inch per turn of the handwheel, either of



Kempsmith Vertical Maximiller with Adjustable Spindle

which may be obtained through a knob in the center of the handwheel. The machines can also be furnished without power feeds.

Some of the important specifications of the No. 2 machine are as follows: Power longitudinal table feed, 28 inches; power transverse table feed, 12 inches; power vertical table feed, 19 inches; vertical adjustment of spindle, 6 inches; number of spindle speeds, 18; and weight of machine, about 6800 pounds. Similar specifications of the No. 4 machine are as follows: Power longitudinal table feed, 42 inches; power transverse table feed, 16 inches; power vertical table feed, 20 inches; vertical adjustment of spindle, 6 inches; number of spindle speeds, 18; and approximate weight of machine, 9800 pounds.

BROWN & SHARPE AUTOMATIC DUPLEX MILLING MACHINE

A No. 37 two-spindle automatic milling machine of the manufacturing type is being placed on the market by the Brown & Sharpe Mfg. Co., Providence, R. I. This machine follows the design of the B. & S. single-spindle automatic milling machine described in March, 1923, MACHINERY. The spindles of the new machine permit the simultaneous use of two face mills or of two gangs of cutters. By using cutters on arbors, a piece can be milled above and below at the same time. The inside spindle rotates in one direction only, at a speed determined by the change-gears used, while the outside spindle may be run either forward or reverse at a speed that is also controlled by change-gears. Reversal of this spindle is easily accomplished by throwing a lever at the base of the head. On work requiring the use of only one spindle, the outside spindle can be set to remain stationary.

The machine is of the constant-speed driven type with independent spindle and table drives. Speed changes for the spindles and the table are accomplished independently of each other, thus giving a wide range of table feeds for any spindle speed and vice versa. The spindle heads are mounted on uprights which are located one on each side of the table. Each spindle is provided with independent vertical adjustments and separate sets of change-gears giving independent speed changes for each spindle. The upright on which the main spindle is mounted is cast integral with the bed, while the outside upright is provided with a sidewise adjustment of 7 5/8 inches.

A feature of the machine is the full automatic table control, which includes a constant fast travel, variable cutting feed, reverse, and stop. Any or all of these may be used during a cycle of operations, and are obtained automatically by adjustable dogs located on the front of the table. Starting, stopping, and reversing are controlled by a hand-lever on each side of the saddle. Another hand-lever on the left-hand side of the saddle controls the cutting feed and the constant fast travel.

The automatic operation of the table with a feed in either direction makes it possible to have a work fixture on each end of the table. With this set-up, when the machine is started, the work in one fixture is brought up to a point where the cutters are about to engage, at a constant fast travel of 210 inches per minute, after which the cutting feed is automatically engaged. At the completion of the cut, the table is automatically reversed, the constant fast travel re-engaged to bring the work in the other fixture up to the cutters, and then the foregoing cycle is repeated. With this method, the operator may load one fixture while work is being milled in the other.

Other types of operation are possible; for example, it may be advantageous to have the table reverse at either end of its travel and stop at the other, or to stop at both ends of its travel. This can be accomplished automatically, and to start the table again, it is only necessary to operate the control lever located at each end of the saddle. Work fixtures are designed to permit loading in the shortest possible time, which, in conjunction with the constant fast travel and the automatic operation, permits the machine to cut almost constantly. Partly automatic operation of the table may be arranged to meet the needs of special conditions.

In addition to the regular application of the machine for arbor- or face-milling, the use of various special attachments is possible. Multiple or angular heads or simple horizontal and vertical heads may be used. Such special attachments enable the machine to perform a particular job efficiently and still leave the machine available for other work requiring a different set-up.

Fig. 2 illustrates a typical job for which special fixtures and attachments are used. This job consists of milling the support seats of flywheel housings, six surfaces being milled in four planes. A vertical-spindle milling attachment is provided on each machine head, and cutters are used in the regular horizontal spindles. Two fixtures are located at one end of the table.

In this operation, the work in the first fixture is brought up to the cutters at the fast travel, and the cutting feed is automatically engaged. When the cut is finished, the work in the second fixture is brought up to the cutters at the fast travel, and the cutting feed is again engaged. During this

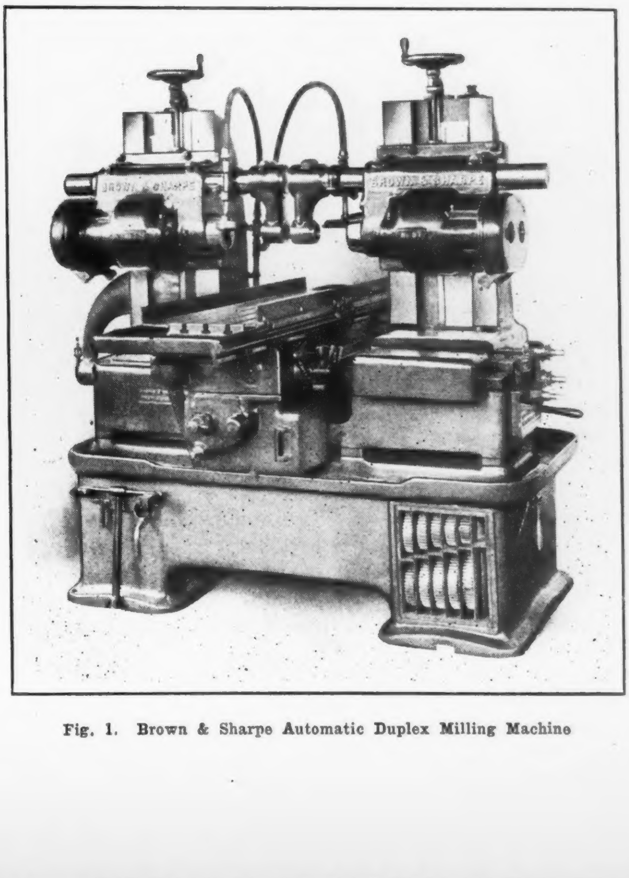


Fig. 1. Brown & Sharpe Automatic Duplex Milling Machine

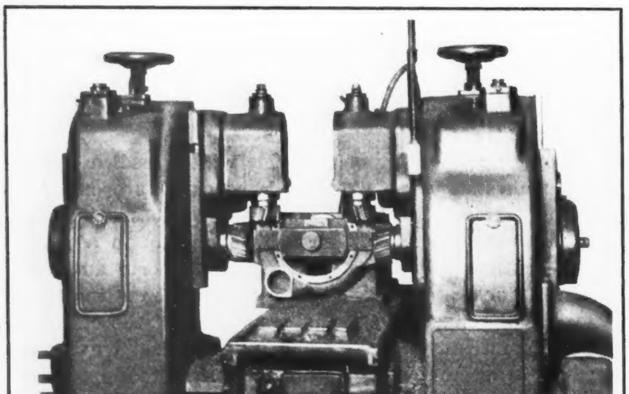


Fig. 2. Operation in which Two Vertical Spindles are used in Conjunction with the Horizontal Spindles

cut, the operator unloads the completed work in the first fixture and leaves it empty. When the work in the second fixture has been finished, the table reverses and returns at the fast travel to the original loading position, where the first fixture is reloaded and the fast travel reengaged. While the new piece in the first fixture is being milled, the work in the second fixture is replaced. In this cycle the only delay is the time necessary to load the first fixture.

OLSEN-LUNDGREN VERTICAL BALANCING MACHINE

Flywheels, pulleys, clutch parts, disks, etc., may be balanced both statically and dynamically in a No. 3 vertical-spindle balancing machine recently developed by the Tinius Olsen Testing Machine Co., 500 N. 12th St., Philadelphia, Pa. The principle of this machine, in general, is the same as that of the Olsen-Carwen horizontal type of balancing machine, in which an unbalance is created in the machine to counteract the unbalance in the body being tested. When the unbalance created in the machine is of the same magnitude as the unbalance in the body under test, and the two planes of unbalance in the test piece and the machine are in opposite directions, the whole unit comes to rest and is said to be in balance. The amount of artificial unbalance is registered direct on dials, and the machine also registers both static and dynamic unbalance, together with the angle of unbalance, and indicates the axial position of the static unbalance. This prevents the introduction of a dynamic couple in correcting any static unbalance, and in cases where dynamic unbalance does not exist, the body may be put in perfect balance by correcting at one point only. The machine will also show whether or not a dynamic couple exists in the body being tested, before a reading is taken.

The principal elements of the machine consist of a baseplate and support stand which are bolted together, a static cradle, and a dynamic unit. The baseplate and support stand always remain in a fixed position, while the static cradle is fastened by means of two plate hinges or springs to the supporting stand and is free to vibrate around a vertical axis that is parallel to the stand. It acts as an intermediate support for the remaining parts of the machine, and by shifting the hand-lever at the upper right-hand corner on the front of the machine, this unit can be locked to the stand or unlocked.

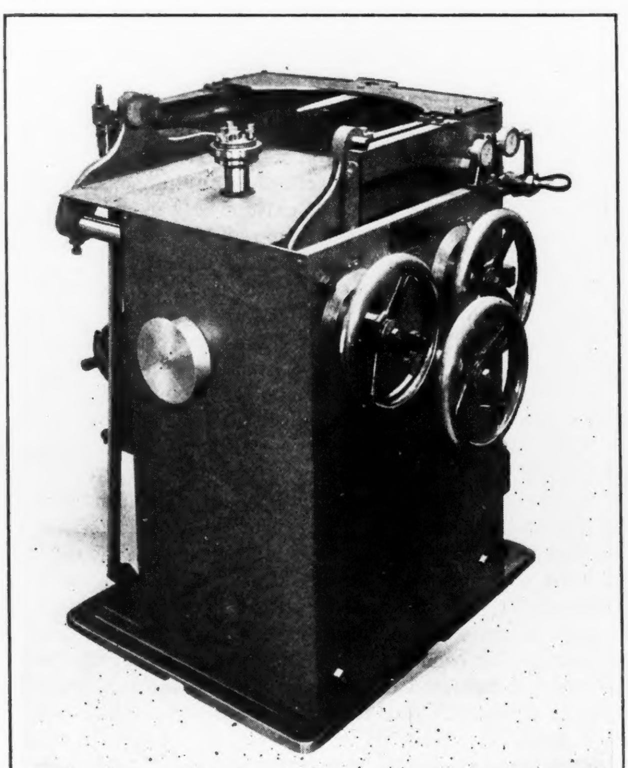
The dynamic unit comprises the machine proper, and consists of a front and a back plate which are held together by four stay-rods. All indicator dials, machine parts, and the motor are mounted on this unit. It is supported by two knife-edge pivots which rest on top of the static cradle, and it is free to vibrate around a horizontal axis or plane at right angles to the axis about which the static cradle vibrates. This third unit can be locked to the static cradle or unlocked by turning the handwheel at the upper right-hand corner on the front side of the machine.

When the cradle is locked to the support stand, the dynamic unit is free to vibrate, and when the cradle is free from the support stand, the cradle and dynamic units are locked together and vibrate as one complete unit around the vertical axis. The upper right-hand wheel on the front of the machine is used to operate balancing blocks to regulate the unbalance of the machine sufficiently to counteract the unbalance in the piece being tested. The upper left-hand wheel changes the angular position of the balance blocks so that the unbalance created can be made to act in the opposite plane to the unbalance in the work. The lower central handwheel is used to raise and lower the spindle and the part being balanced. An adapter which is screwed on the head acts as a support and clamping device for the work.

In operation, the part to be balanced is placed on the spindle and locked to the adapter. The dynamic unit is then made free to vibrate, after which the machine is started. The spindle is next moved up and down by turning the lower central handwheel until vibrations cease, after which the locking lever is shifted to the static position and the amount of static unbalance determined by operating the two upper handwheels until the indicator dial shows that there is no vibration. The power is next shut off, and the machine turned by hand until the pointer on the left-hand side of the machine indicates zero on an aluminum disk or indicator wheel. An indicator on top of the machine is then pulled out to show the plane and axial location of the point where metal should be removed from the work.

The amount of static unbalance is registered on the outer edge of the unbalance dial in ounce-inches, in the case of English measurements, and in centimeter-kilograms, when the metric system is used. The amount of unbalance divided by the radius at which the correction is to be made equals the weight to be removed to correct the unbalance. Corrections are generally made by drilling out metal, and to facilitate production, it is advisable to make up a chart that gives the depth to be drilled with a fixed size of drill for a given radius and a given reading of the machine.

When it is found impossible to make vibrations cease in the first or dynamic setting of the machine at any position of the spindle, a dynamic couple exists. Then the proper procedure is to place the piece to be balanced at a height where the least vibrations occur, which is the best axial location for correcting the static unbalance. The dynamic reading is then taken in the same manner as the static reading.



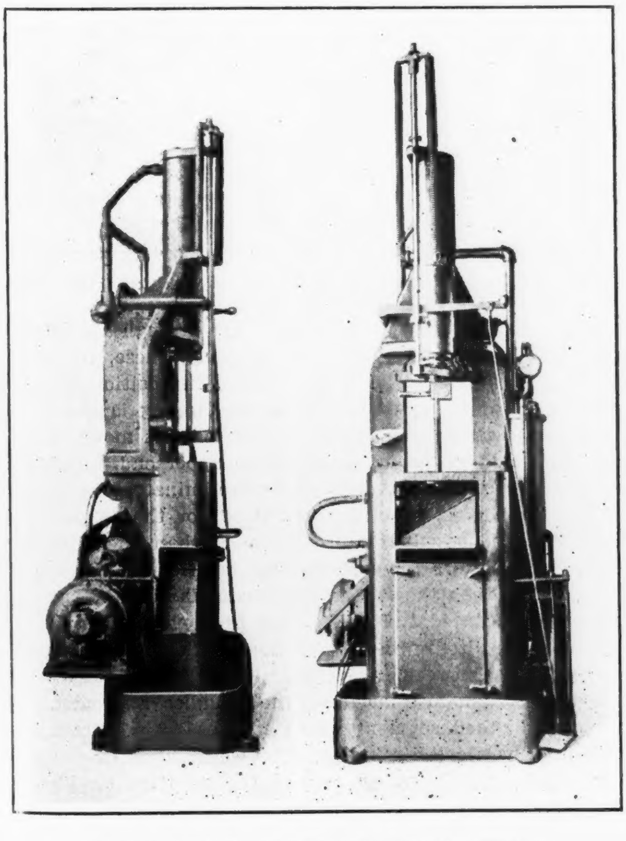
Olsen-Lundgren Balancing Machine for Flywheels and Similar Parts

AMERICAN BROACHING MACHINE

A semi-automatic vertical hydraulic broaching machine of the pull type, which has recently been brought out by the American Broach & Machine Co., Ann Arbor, Mich., is shown in the accompanying illustration. In the right-hand view, the broach has completed its upward stroke, at which point the work drops on the angular table and slides down the chute seen in the left-hand view. At the beginning of an operation, the disconnected shank end of the broach projects above the top of the angular table to permit placing the work over the shank. When this has been done, the operator applies a slight pressure on one of the foot-pedals at the right of the machine, which controls the lower hydraulic cylinder. The broach is then pulled upward until it automatically connects with the pull-head.

The operator next pushes the second pedal at the right, which controls the upper hydraulic cylinder, to start the upward movement of the pulling ram, and this member rises until the work drops from the broach, as already mentioned. A knock-off stop then immediately trips a control lever which automatically starts the machine on the return stroke. When the pull-head reaches a point about 5 inches from the lower end of this stroke, the head automatically releases the broach, and this tool drops through a soft metal guide in the angular table and a soft metal bushing in the upper end of the lower cylinder until it strikes a soft metal disk also mounted in the lower cylinder. In this process of dropping and striking, all chips are discharged from the broach. The entire machine cycle is performed in about eight seconds.

The machine is equipped with a pump for supplying cutting lubricant just beneath the angular table. Broaches up to 18 inches in over-all length may be used, and the machine is particularly adapted to such operations as sizing round or splined holes and broaching hexagon, serrated, and other shapes of holes. A direct-reading gage, graduated in pounds and tons, is provided so that the amount of pressure being exerted can be observed at all times. There is also a relief valve which can be set for any maximum pressure to prevent the breakage of broaches. The machine is furnished with a full-flow twin-screw, constant-pressure pump. It has a capacity of 8 tons and weighs approximately 3400 pounds.



American Semi-automatic Hydraulic Broaching Machine

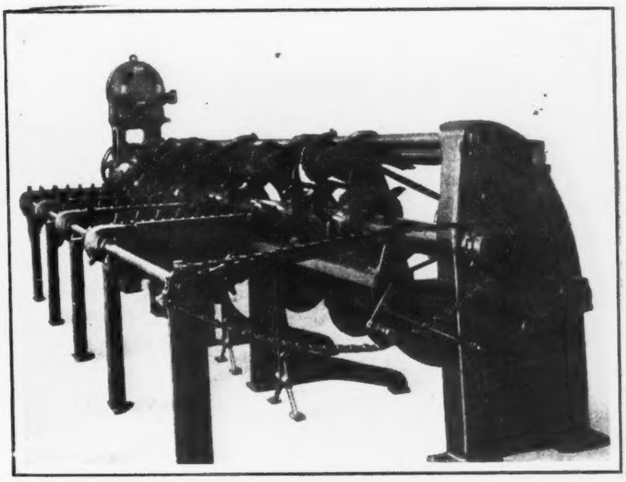


Fig. 1. Davis "Rotomatic" Machine for automatically threading Pipe of Various Diameters and Lengths

DAVIS THREADING AND MILLING MACHINES

A "Rotomatic" machine, recently built by the Davis & Thompson Co., 57th Ave. and Mitchell St., Milwaukee, Wis., for automatically threading pipe, is illustrated in Fig. 1. Machines of this type are in use for threading butt-welded pipe as it comes from the cooling rack, only one pair of machines being required for a furnace. The machine is automatic in that the pipe is picked up, gripped, threaded, and discharged without being touched by the operator. It is possible to connect the machine with a conveyor leading from the cooling station, as illustrated, thus eliminating the necessity of using cranes and conserving a large amount of floor space and labor.

The machine is similar to other Davis machines of the rotating type, the rotating members being housed and automatically lubricated. The drive is through a variable-speed motor, belt-connected to the driving pulley, an idler providing belt tension. If direct-current is not available, a constant-speed motor may be used and change-gears furnished for obtaining different speeds. There are six spindles, the longitudinal movement of which is controlled by floating and positive cams. Die-heads having an automatic closing mechanism are mounted on these spindles. They are internally tripped, can be set for any desired number of threads, are easily adjusted for size without removing them from the spindles, and can be quickly removed when necessary. They are lubricated by a motor-driven pump located in the base of the machine having a delivering capacity of 20 gallons per minute.

The six-station work drum rotates in synchronism with the spindle drum. The automatic conveyor carries the pipe over power-driven rolls which advance it to a stop in line with the dies, from which it is delivered to the loading station fingers and thence to the chuck jaws. The pipe is next gripped automatically by means of the Davis patented chain clamp for the threading operation, after which it is discharged on the opposite side of the machine. Pipe from 1/2- to 2-inch inclusive, and in random lengths up to 22 feet, may be handled without adjustment. A reamer may be used in connection with the dies so that pipe can be reamed during the threading operation. This machine is marketed by William K. Stamets, Jenkins Arcade Bldg., Pittsburg, Pa.

Fig. 2 illustrates a No. 2 drum-type milling machine recently produced by the same company. Each cutter-head of this machine has two spindles for which there is an endwise micrometer adjustment. The two cutter-heads are moved along the ways of the machine to adjust the distance between the cutters, by means of a 2-inch screw. The work mandrel is 10 inches in diameter. Any desired feed can be obtained through change-gears located under the cover at the left-hand end of the machine. This machine is particularly adapted to the use of the chain-cable clamping

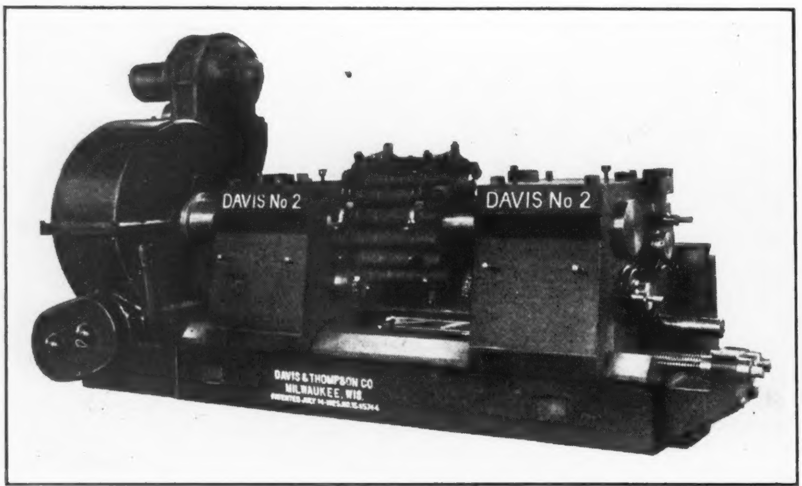


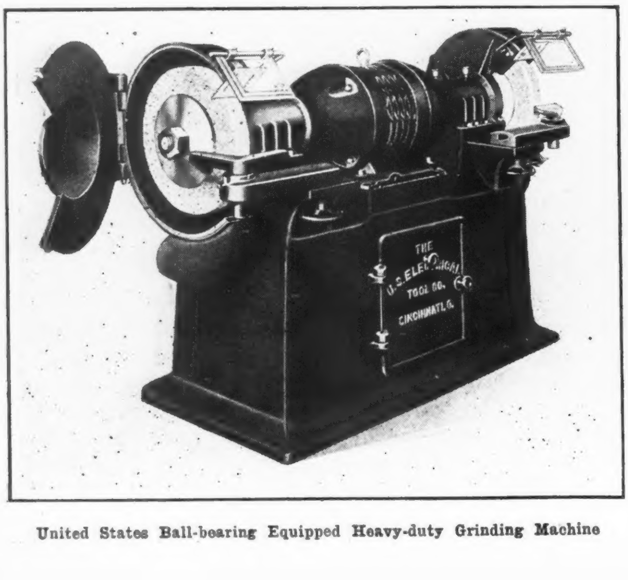
Fig. 2. Davis Drum Type Milling Machine

arrangement employed on other machines built by the same company, but which is not illustrated here. The machine will take 14-inch cutters, and is arranged for delivering coolant to the cutters. It weighs approximately 20,000 pounds.

UNITED STATES HEAVY-DUTY GRINDING MACHINE

A heavy-duty grinding machine, designed for continuous production service and available in six sizes, from 18- by 3-inch to 30- by 5-inch, is being placed on the market by the United States Electrical Tool Co., Cincinnati, Ohio. The machine can be furnished for either alternating or direct current. The motors are of 40-degree Centigrade rating, with a momentary overload capacity of more than 100 per cent. The spindle is made of nickel steel, in one piece, and is mounted in four heavy-duty ball bearings which are enclosed in dustproof boxes. All alternating-current grinders are equipped with a remote control to assure motor protection under all conditions. This control is in the base of the machine, and has an overload cutout and a no-voltage release. The push-button station is on the motor frame. Direct-current machines are regularly equipped with manually operated starters and a fuse switch, but a remote control can also be furnished.

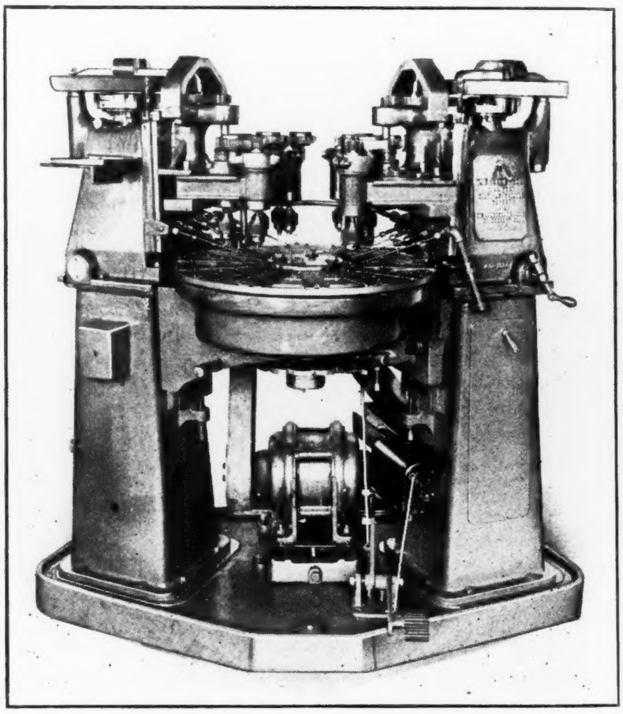
The wheel guards are equipped with exhaust connections, hinged doors, spark breakers, and adjustable unbreakable glass eye-shields. The tool-rests are rigid and arranged for convenient adjustment. A positive shaft-locking device is provided to hold the grinding-wheel spindle while renewing wheels. The 18-by 3-inch alternating-current grinder carries a 5-horsepower motor, operates at a no-load speed of 1120 revolutions per minute, and weighs about 1700 pounds. The 30- by 5-inch alternating-current grinder carries a 15-horsepower motor, operates at a no-load speed of 680 revolutions per minute, and weighs about 3300 pounds.



United States Ball-bearing Equipped Heavy-duty Grinding Machine

ANDERSON TEN-SPINDLE TAPPING MACHINE

The latest development of the Anderson Die Machine Co., Iranistan Ave., near Admiral St., Bridgeport, Conn., consists of a ten-spindle tapping machine equipped with a dial feed having a dial 16 inches in diameter. Briefly, the machine comprises two units of the well-known five-spindle dial-feed tapping machine built by this company. The two units are mounted on one base and operated in synchronism by means of a horizontal shaft at the rear. This shaft has bevel pinions at the ends which mesh with gears mounted on a worm-shaft that constitutes the main drive shaft for each unit. Power is delivered to the rear horizontal shaft by belt from a 1 1/2-horsepower motor. Pulleys of various sizes can be furnished to give any desired speed.



Anderson Dial-feed Tapping Machine equipped with Ten Spindles

The dial is indexed by means of a cam through a connecting-rod which oscillates a yoke and pawl, these, in turn, operating a ratchet. The dial is locked in position during that portion of the cycle in which the tapping is done, by means of a cam-controlled bolt. The ratchet is mounted on a vertical shaft having a flange at the upper end, to which the dial is secured. This arrangement eliminates the necessity of providing teeth in the dial itself for the purpose of indexing. It is possible to present more than one piece to the tapping spindles for each indexed position. The advantage of this lies in the fact that the machine can be run at a slow rate of speed and still give a high production. The slow speed results in the dial being stationary a greater length of time between indexings.

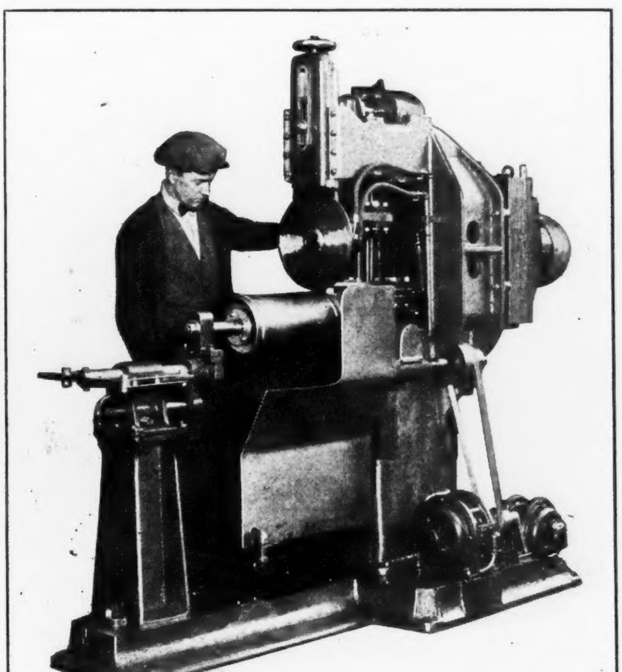
As on the standard machine, the spindles are operated through a toothed segment which meshes with a train of gears that operate the spindles. This segment is driven by an adjustable crank which rotates the spindles clockwise during the tapping, and counter-clockwise for withdrawing the taps from the work. The timing of the machine is con-

trolled by the crank that operates the segment, the cam that raises and lowers the head containing the spindles, and the cams that operate the indexing and locking device of the dial. All these elements are mounted on a common shaft which runs vertically through the center of each unit, and they are provided with adjustments so that the two units can be timed accurately. After being secured in place, these elements cannot change their positions, and so the timing remains constant.

The particular machine illustrated is tooled up to tap ten holes in one operation in a sheet-metal part approximately 8 inches long by 2 inches wide. It is timed to give about 20 strokes per minute, making it possible to tap 1200 pieces or 12,000 holes per hour. Dials can be made for feeding parts of greatly varying shapes. One of the units may be used for drilling and countersinking or counterboring, while the other one is used for tapping the holes drilled in the first section.

GENERAL ELECTRIC RESISTANCE WELDERS

Two automatic resistance welding machines, one for straight-seam work, and the other for circular-seam work, are the latest developments of the General Electric Co.,



General Electric Resistance Welder for Circular Seams

Schenectady, N. Y., in the welding field. In resistance welding, fusion is effected by heat generated in passing electric current through the materials to be welded, augmented by pressure, whereas arc welding utilizes an arc or flame to melt the work or electrode or both. The new automatic resistance welders consist of a framework for holding the work, a transformer for supplying electric current to the electrodes, movable electrode wheels, and the necessary means of control.

The equipments are particularly designed for welding the seams of light metal containers, such as ice-cream cans, drums, etc., and are suitable only for making lap joints on relatively thin metal. Among the advantages claimed are the absence of flames or open arcs, making the use of masks unnecessary, and the fact that the operator requires no special welding training. The welding speed varies from approximately 20 to 100 inches per minute, depending on the nature and thickness of the material being welded. Material up to a total thickness of 1/4 inch can be handled on these machines.

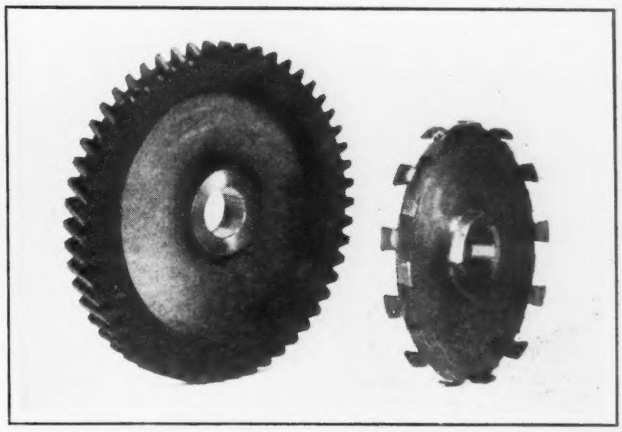


Fig. 1. Improved Micarta Gear and Pressed-steel Web or Hub

IMPROVED MICARTA GEARS

New developments in the construction of micarta timing gears have been made by the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa. The rim portion of these gears now consists of a multiplicity of segments which results in uniformity of structure. The new design also embodies a thin pressed-steel web, such as shown at the right in Fig. 1, affording lateral flexibility for gear tooth alignment. In forming the rim in which the teeth are cut, a number of short segments about 1 inch in length are used, and so, in a 6-inch diameter blank there are eighteen or twenty segments instead of four as in the former construction. This makes the filler threads of the cloth practically radial and the warp threads circumferential in all parts of the rim. The butt ends of the segments in adjacent layers are staggered and this lapping over ties the whole into a well knitted mass when molded.

Several steps are necessary to complete the manufacturing from the treated roll of material to the molded blank. Diamond-shaped pieces are punched at short spacings from a long narrow strip of treated cloth, as shown at the left in Fig. 2. This cloth is then folded lengthwise in the center, as shown at the right, and wrapped to form the stack ready for the mold. All stacks are inspected before molding to insure proper lapping of the ends and thus avoid a weak rim structure. This construction produces a uniform distribution of the threads of the cloth throughout the whole rim, resulting in uniform wearing conditions on all teeth. Finer weave cloth is also used, which requires slightly over 100 layers to form an inch of molded width.

The thin pressed-steel center or web design has the advantage of a metal mounting or seat, and still provides flexibility to take up any possible lateral motion or vibration of the crank gear, resulting from "whip" of the crankshaft and inaccuracies in the teeth of meshing gears. In addition to the flexible property, this type of web also embodies the advantages of a positive anchorage of the micarta rim to the web.

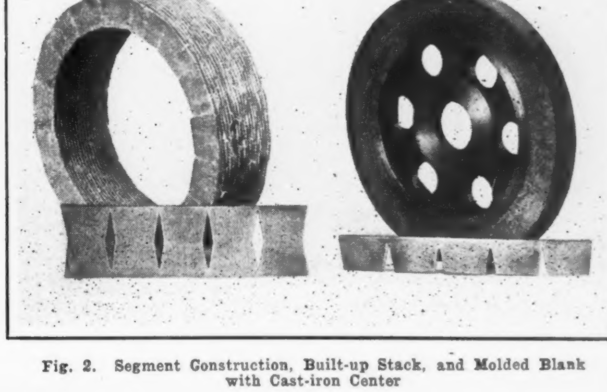
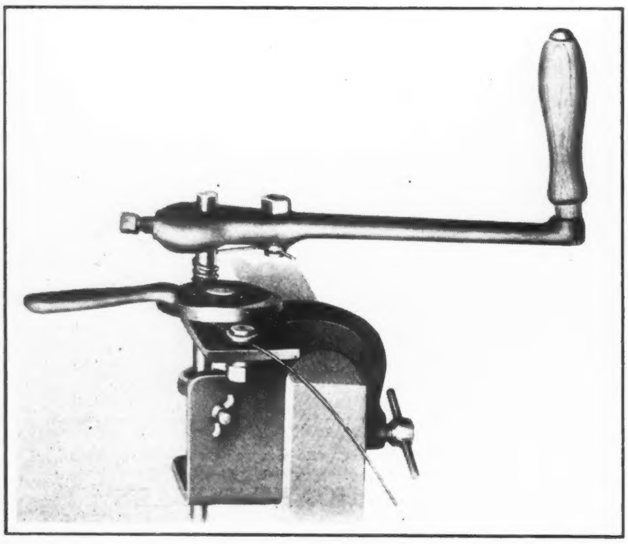


Fig. 2. Segment Construction, Built-up Stack, and Molded Blank with Cast-iron Center



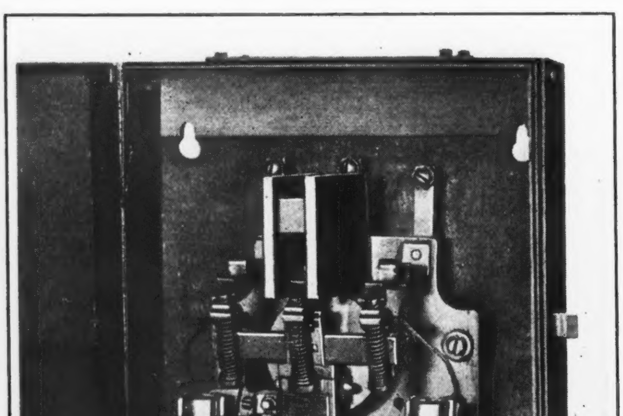
Fostoria Spring Winding Device

FOSTORIA SPRING WINDER

Coil springs of various diameters and lengths can be made conveniently to the desired lead, right- or left-hand, by means of a spring winder recently placed on the market by the Fostoria Screw Co., Fostoria, Ohio. From the accompanying illustration it may be seen that the diameter of the spring is determined by the size of the mandrel used. The lead is governed by the position of a small cam that can be adjusted as desired.

WESTINGHOUSE ACROSS-THE-LINE STARTERS

Reversing and non-reversing types of across-the-line starters, which are applicable to machine tools, woodworking machinery, conveyors, blowers, pumps, etc., constitute a recent development of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa. The starter unit is held in place in the sheet-steel cabinet by means of two slotted hexagonal-head screws. It may be taken out as a unit by merely removing the screws, leaving all the room within the cabinet for attaching conduit bushings and drawing in the leads. The starter is completely enclosed and operated from a push-button station conveniently located, in this way providing a safe control. A floating armature type of 3-volt contactor



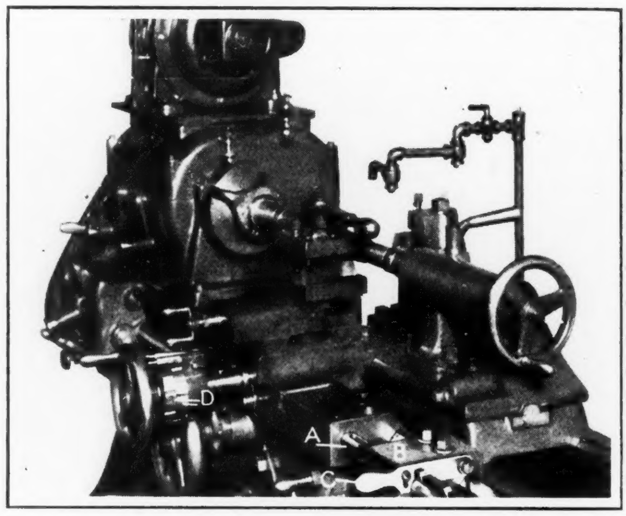
Westinghouse Across-the-line Starter

provides smooth and positive contact. When operating conditions necessitate protecting the starter against an accumulation of chips or other foreign matter, an interlock may be used to make it impossible to start the motor unless the cabinet door is fully closed.

SEBASTIAN SEMI-AUTOMATIC LATHE

A heavy-duty production lathe, equipped with length and diameter gages, has been added to the line of machines built by the Sebastian Lathe Co., Cincinnati, Ohio. This new machine is built in 15-, 18-, and 20-inch sizes, and is intended for use in shops where a quantity of duplicate parts must be produced but where the volume of such parts does not warrant the use of an entirely automatic machine. Parts may be turned alike without the use of calipers, gages, or micrometers.

The length gage is a cold-rolled bar *A* attached to the carriage and having suitably placed notches for controlling the positions of the shoulders on the work. It will be seen that there is a bracket *B* secured to the lathe bed and that bar *A* slides through a bearing in this bracket. The notches are made in a bar of rectangular cross-section, which is located in a slot milled in the top of bar *A*. After the job has been



Sebastian Lathe equipped with Length and Diameter Gages

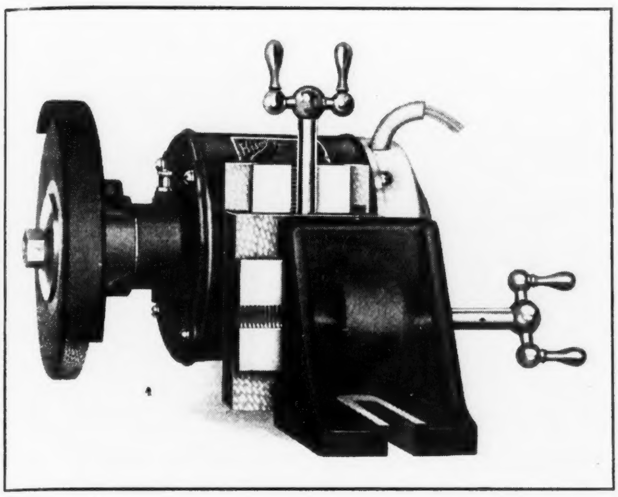
set up, the shoulders are located by nicking the work with the tools on the rear tool-block, the tool being located in the different positions by dropping dog *C*, successively, in each of the notches in the bar.

Diameters are controlled by means of two gages or disks *D* secured to the cross-feed screw. These disks are notched to receive two dogs, which drop into the notches to control the diameter of the work as the front or the rear cross-slide is fed toward the center of the machine. The disks are of such a diameter that a cross-movement of 0.001 inch of the cross-slide corresponds to 1/16 inch on the circumference of the disks; consequently, a high degree of accuracy is obtainable.

Numbers are marked in the notches of both the length and diameter gages so that the operator may select the different notches in the proper sequence. When the special cross-feed gages are not required, a pair of graduated collars may be slipped on the cross-feed screw instead, for controlling the front and rear tools. A brake, to permit quick stopping of the machine, is furnished, and a feed-rod and quick-change feed-box can be provided. The motor may be fitted in a cabinet leg, and a single-pulley drive without a motor can also be furnished.

HISEY DOUBLE-SLIDE GRINDER

A 1/2-horsepower motor-driven grinder mounted on an angle-plate in a double-slide arrangement so that it can be adjusted both vertically and horizontally is shown in the accompanying illustration. This equipment has recently been



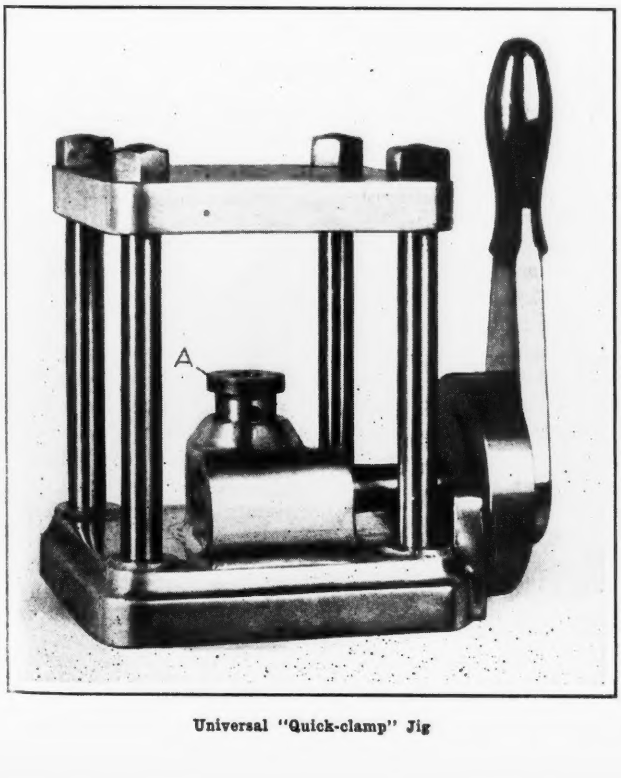
Hisey Grinder which may be adjusted horizontally and vertically on an Angle-plate

placed on the market by the Hisey-Wolf Machine Co., Cincinnati, Ohio. The vertical travel of the grinder is 5 1/2 inches, and the horizontal travel, 4 3/4 inches, the two slides being operated independently of each other. When equipped with an alternating-current motor, the outfit weighs about 68 pounds, whereas a direct-current motor-driven equipment weighs approximately 63 pounds.

"QUICK-CLAMP" DRILL JIGS AND FIXTURES

A line of standardized quick-clamping drill jigs and fixtures intended for use in the single or multiple drilling of parts is being placed on the market by the Universal Standard Sales Co., 500 Murphy Bldg., Woodward at Grand, Detroit, Mich. The range of sizes covers work from a few ounces to several hundred pounds. One of the features of these jigs is the simplicity of the locking mechanism, only a slight downward pressure being required to lock the work in the jig, and a slight upward pressure to release it. This locking mechanism can be furnished for other jigs and fixtures. Bushing plates and adapters may be readily replaced so as to accommodate a large number of parts.

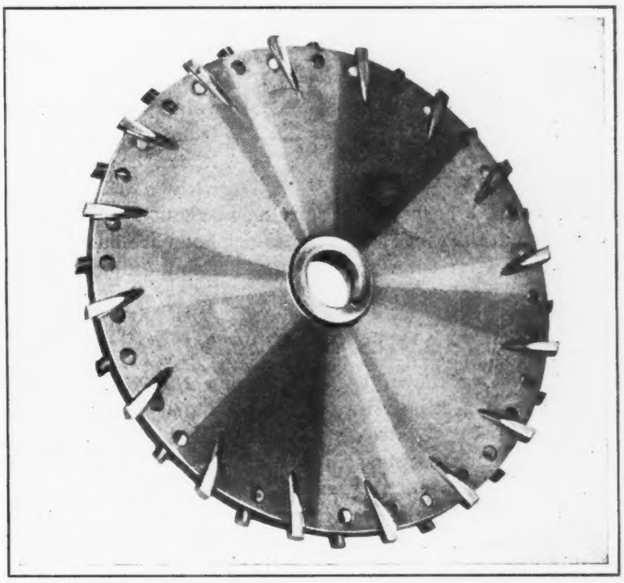
The four-post "type 4" jig shown in the accompanying illustration is intended to replace the common box type of jig. Briefly, it consists of a square or rectangular base with four corner posts supporting the bushing plate which is bored to receive the drill bushings required for a given job. Pillar *A* is moved upward by means of the handle, to support the work rigidly against locaters on the under side of the bushing plate. One or more of these pillars may be provided. A "type 2" jig equipped with two pillars to which the bushing plate is attached, is made to replace the screw-bushing type of jig.



Universal "Quick-clamp" Jig

LOVEJOY DEEP SLOTTING CUTTER

A type F deep slotting cutter which is intended to cover the field between the ordinary metal-cutting saw and the solid type of side-mill is being introduced to the trade by the Lovejoy Tool Co., Inc., Springfield, Vt. This cutter is made in diameters of 6 inches and over and in widths from 5/8 to 1 1/8 inches. The blades are held by the Lovejoy positive locking method, and have a slight side clearance. The angle at which they are set in the housing depends somewhat upon the cutting width of the tool. This angular setting of the blades permits the maintenance of a definite width as the blades are adjusted outward previous to grinding. There is a generous grinding allowance on the blades.

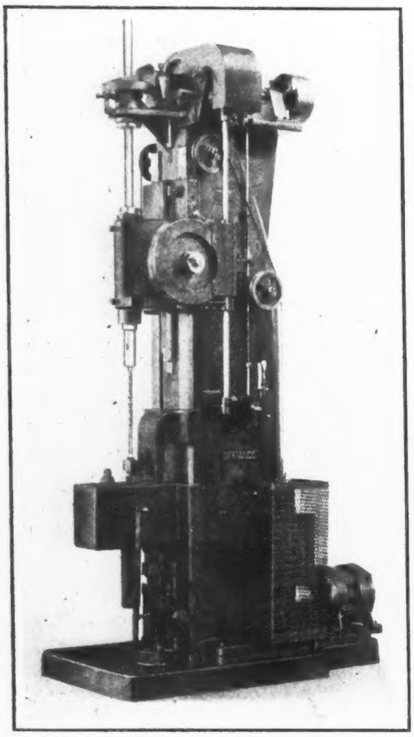


Lovejoy Deep Slotting Cutter with Adjustable Blades

DEFIANCE BURNISHING MACHINE

A machine for burnishing to a high degree of accuracy and smoothness the bronze-bushed holes in steering knuckles and other parts used in the construction of automobiles, etc., has recently been produced by the Defiance Machine Works, Defiance, Ohio. The frame and general construction of this machine are substantial to withstand the heavy duty demanded by production work. The main spindle has a No. 3 Morse taper hole; it runs at 290 revolutions per minute and has a feed of 54 inches per minute. The maximum spindle travel is 18 inches, but the travel can be reduced to any length by setting adjustable stops provided for that purpose. There is a distance of 8 1/2 inches between the center of the spindle and the face of the column.

The carriage that supports the spindle on the vertical slide is actuated by worm-gearing and controlled through a hand-lever which is within reach of the operator from the working position in front of the machine. The feed can be set for a continuous motion of the spindle and saddle up and down or it can be arranged to have them make one complete cycle down, return, and then stop until reengaged by the operator for the next cycle. A lubricant tank is mounted on the lower saddle on the front side of the machine, and the work is immersed in the lubricant during the burnishing op-



Defiance Burnishing Machine

eration. The tank has a vertical movement of 6 inches, being raised and lowered by means of an air cylinder which can be operated by compressed air of from 60 to 100 pounds per square inch. Work-holding fixtures must be made to suit requirements, and they can be clamped in a stationary position on the main slide, leaving the work clear when the lubricant tank is dropped into its lowest position.

The machine can be arranged with a single-pulley drive from the rear or it can be provided with a direct-connected motor of 3 horsepower, running at about 1150 revolutions per minute. From 60 to 75 holes per hour are burnished on this machine, and it weighs about 4250 pounds.

HANNA RIVETER

A new riveter, known as the "Hanna Rapid Riveter," which permits inserting rivets from above and driving from below, at a speed of 50 strokes per minute, has been brought out by the Hanna Engineering Works, 1763 Elston Ave., Chicago, Ill. The mechanism consists of a combination of a simple lever and toggle, which permits a long die stroke and a wide range of uniform pressure, thus eliminating the necessity of a screw adjustment on the die. The die travels very rapidly as it approaches the work, and then the speed is gradually decreased until the die enters the uniform pressure area of the stroke. The advantage of this method of controlling the die stroke is that the speed is greatest when the work is lightest, and when the rivet head is formed, the pressure increases until it reaches the maximum, which is then maintained for several inches of piston travel. The ordinary variations in rivet lengths and plate thicknesses are automatically taken care of by the wide range of uniform pressure. The machine is built in sizes capable of driving from 1/4- to 1/2-inch rivets hot, and from 3/16- to 3/8-inch rivets cold. It can also be used for punching.

Hanna Riveter for Rapid Driving of Rivets

READING TEE-BAR MONORAIL SYSTEM

In a new monorail system for hoists which is being introduced to the trade by the Reading Chain & Block Corporation, Reading, Pa., the rail or track is a standard mill tee-bar. The size of the tee-bar used for an installation depends upon the rated load. Bends are made cold to meet conditions in the shop. The wheels of the trolley run on the flat horizontal flanges of the tee-bar.

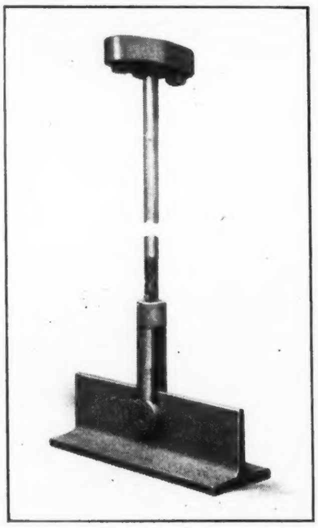


Fig. 1. Method of suspending the Tee-bar Track

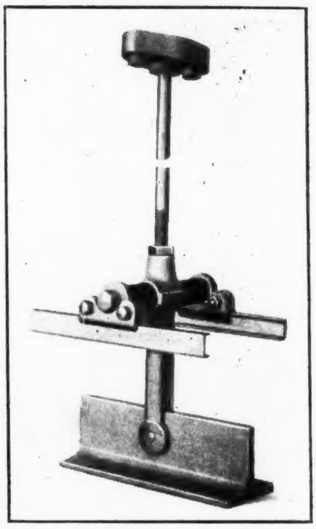


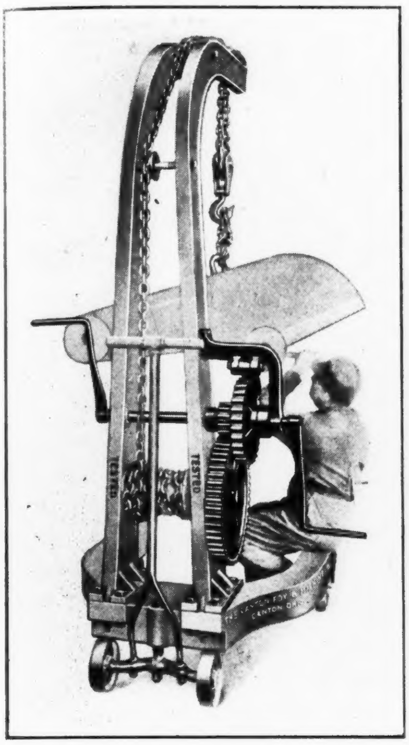
Fig. 2. Arrangement of the Electrified Tee-bar System

Standard track sections are furnished in 20-foot 6-inch lengths and in multiples of 3 feet 6 inches, which is the standard spacing of the suspension rods for a 1- or 2-ton system. With systems of 1500 pounds capacity and under, the spacing is less. At the points of suspension, a forged-steel clevis is fastened to the tee-bar, as shown in Fig. 1, by means of a pin which is placed in double shear and has an ultimate strength of over ten times the allowable working load. The upper end of the clevis is threaded for connection to a 5/8-inch round steel suspension rod. There is a 3-inch vertical adjustment for this connection, so as to permit a level track under all conditions. Clevises are rapidly attached to the track by means of a hollow-head wrench. The hanger rods are fastened to the ceiling or other overhead structure by means of standard fittings, of which a complete line is available to meet all conditions.

Right-hand, left-hand and three-way switches, as well as cross-overs, may be supplied. Each switch is provided with a lock that cannot be opened by passing traffic or vibration. A nominal pull on a cord suffices to throw the switch into the desired position, but motor-operated switches with a remote control can be furnished. Safety stops prevent carriers from leaving the track. The system may be electrified for carriers fitted with electric hoists by installing channel irons (see Fig. 2). Both hand-operated and motor-driven carriers are built in capacities from 500 to 4000 pounds.

CANTON PORTABLE CRANE

A portable crane equipped with a safety friction brake which guards against a load dropping of its own accord has

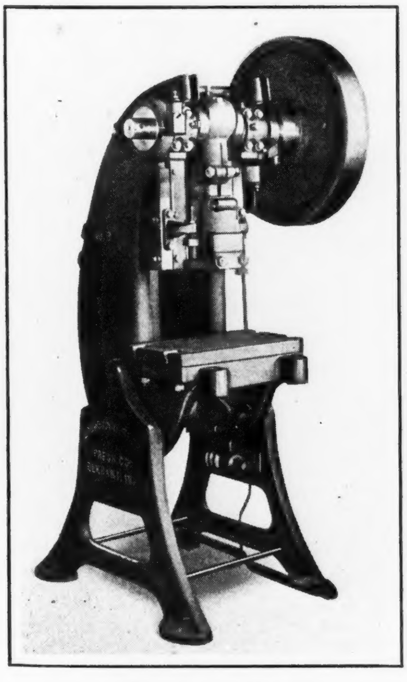


Canton Portable Crane with Safety Brake

recently been brought out by the Canton Foundry & Machine Co., Canton, Ohio. By means of this brake, a load can be held indefinitely at any height, as illustrated, thus insuring safety to both the operator and work. The load brake consists of friction disks, which are used in connection with a helical cam. It holds the pawl positively in engagement with the ratchet, so that it is necessary to turn one of the cranks to lower the load as well as to raise it. Under no conditions can the load act as a driver and lower itself with danger to the operator. The new brake can also be applied to the older types of Canton portable cranes now in use.

LOSHBOUGH-BECK INCLINABLE POWER PRESS

The high-speed, heavy-duty inclinable power press here illustrated is now built in six sizes by the Loshbough-Beck Press Co., Elkhart, Ind. One of the features is the tripping mechanism, which is designed to reduce fatigue on the part of the operator and thus speed up production. The clutch is of a square sliding type, and is instantaneous in action. It is provided with a device for locking the clutch pin while it is withdrawn, to give convenience and safety in setting dies or making adjustments, without removing the belt from the flywheel. The releasing latch is equipped with a safety stop that prevents the press from repeating.



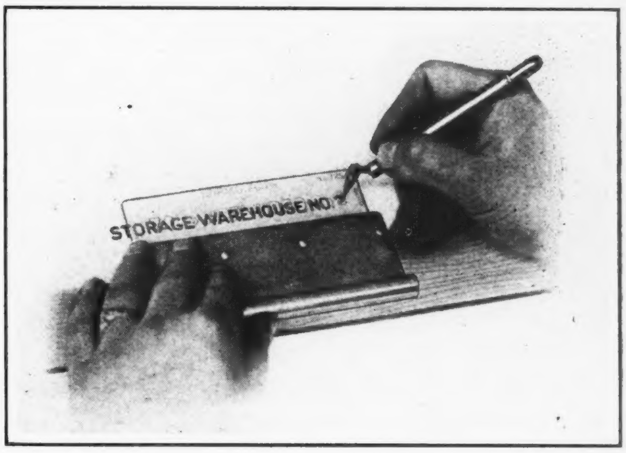
Loshbough-Beck Power Press

The ram has well proportioned V-shaped guides which are accurately fitted in alignment with the bed. With proper adjustment of the ram, the guides are always in full contact with the ways. The ram is also provided with a positive knock-out and a convenient arrangement for adjusting the ball connection. Either square or round punch shanks may be clamped in the square hole of the ram, and extension lugs on the lower end of the ram permit the attachment of large dies. The ram is adjustable from both sides so that it is possible to keep it in alignment as it wears. The connecting-rod is of the solid ball and screw design, and is easily adjusted and locked in position.

The flywheel is made of the solid-web type to eliminate the danger of accidents to the operator. It is provided with a removable cast-iron bushing which may be replaced when worn without reboring the wheel. Holes in the rim facilitate turning the wheel by hand. The brake is of the spring tension type.

"NORMOGRAPH" LETTERING DEVICE

A device known as the "Normograph," which is intended to enable anyone to letter drawings neatly as regards uniformity of size and evenness of line, has been brought out by the Keuffel & Esser Co., Adams and Third Sts., Hoboken, N. J. This device consists of a templet made of transparent xylonite, and a metal holder or guide, which are used in conjunction with a lettering pen, as illustrated. Openings or perforations are so formed in the templet that the letters of the alphabet and numerals can be conveniently formed by moving the pen in contact with the edges of the perforations. There are as few openings as possible, and many characters can be made by means of a single opening. No more than two openings are ever required for one character.



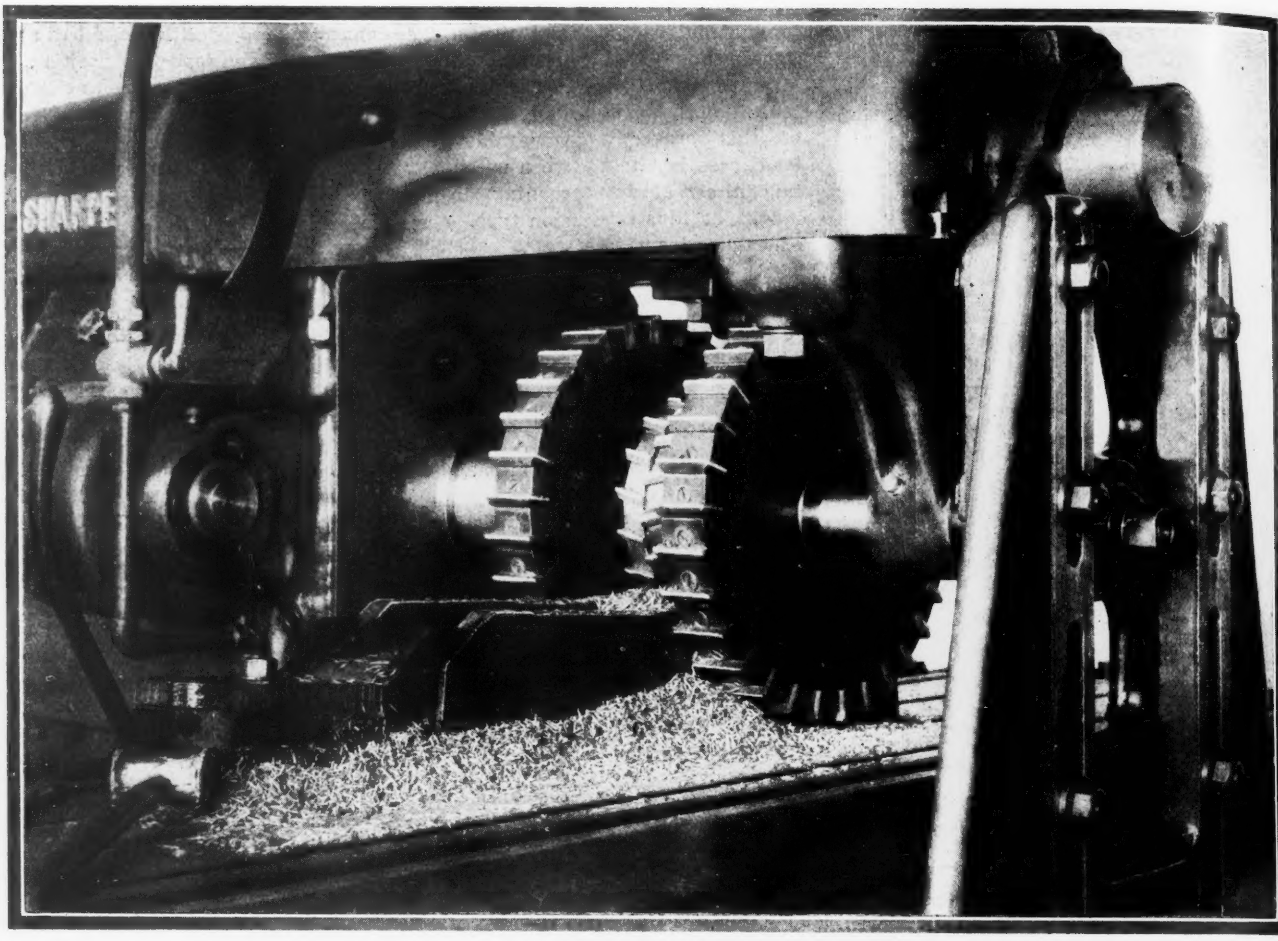
Lettering a Drawing by Means of the "Normograph"

The templet fits into metal jaws on the guide, and is moved over the work by sliding the guide on top of a T-square, to avoid smearing wet ink. Considerable ink can be held in the pen at one time, as the pen is made funnel-shaped.

PRATT & WHITNEY MODEL B LATHE

A 20-inch size has been added to the line of model B lathes manufactured by the Pratt & Whitney Co., Hartford, Conn., a division of the Niles-Bement-Pond Co., New York City. This new size is similar to the 13- and 16-inch machines described in September, 1923, MACHINERY, but the increased swing, with the necessary increased power and strength, has resulted in several interesting departures in construction. As in the previous machines, the motor is mounted in the cabinet leg beneath the headstock, a 7 1/2-horsepower motor constituting the regular equipment. However, the drive may also be through a constant-speed single pulley driven from a lineshaft.

There are sixteen spindle speeds ranging from 8 to 383 revolutions per minute, instead of the usual eight speeds. A lathe of this size is frequently used for boring both small and large holes in jig work, and to do such work efficiently, the greater speed range is needed. The range of speeds is also necessary in order to maintain a fairly constant cutting speed, whether turning small work or pieces up to 20 inches in diameter. The speed changes are made by means of the same convenient levers on the front of the headstock as on the other machines, but there is an extra lever which is

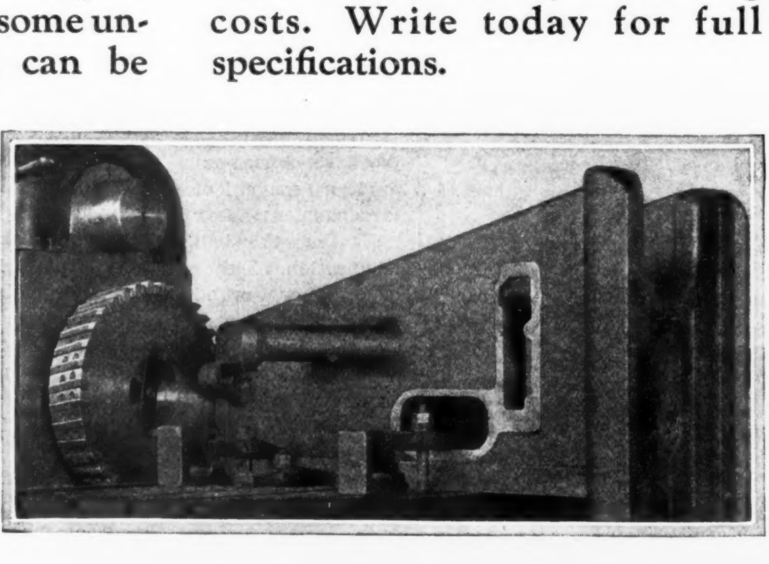


Here is weight, power, and accuracy enough to make deep cuts in your heavy-milling costs

You can keep Brown & Sharpe Milling Machines loaded with heavy "hogging" jobs. There's plenty of room on the rugged table for big pieces. Or, you may want to put through some work on which accuracy rather than fast cutting is important. Any ordinary, and some unusual kinds of milling can be finished right and quickly on these all-round producers.

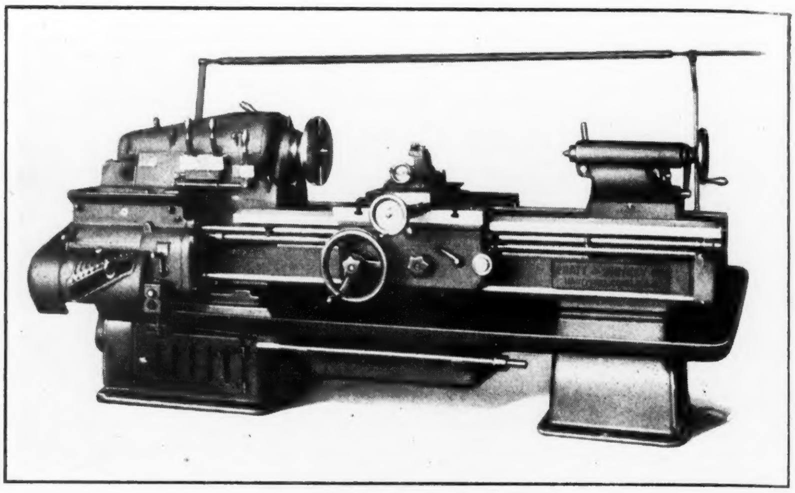
Brown & Sharpe Milling Machines are heavy enough, powerful, and accurate enough, and operated easily enough to make new low records in your milling costs. Write today for full specifications.

"There is plenty of room on the rugged table for big pieces."



used to shift a high- and low-range speed-change gear on the main drive shaft. All headstock gears are of the Maag System and are ground to make them quiet and smooth running. The lower gears of the headstock train dip into a reservoir of oil to splash the lubricant on the other gears, but in addition, a geared pump delivers oil up to a spreader which sprays it over the top of the entire train of gears.

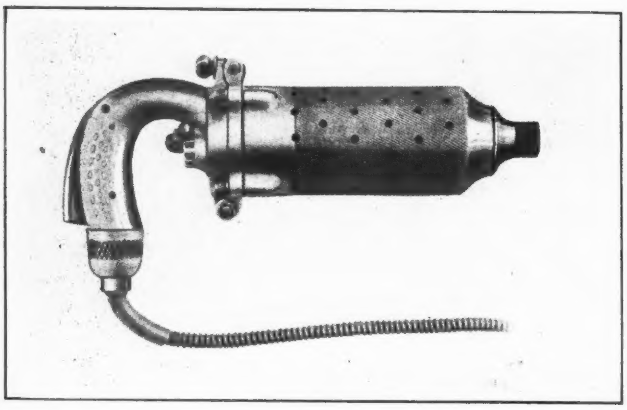
The hole through the spindle is 2 inches in diameter and the taper hole in the spindle nose is ground to a No. 19 Jarno fit. Both a lead-screw and a feed-rod are provided, a device being so arranged that when the feed-rod is being used, the lead-screw is idle and vice versa. Three lengths of bed are available for this machine to give maximum center distances of 48, 72, and 96 inches. The weight of the 48-inch machine is approximately 6200 pounds without the motor or other electrical equipment.



Pratt & Whitney Model B Lathe

SIMBI PORTABLE ELECTRIC HAMMERS

Two portable electric hammers weighing 7 and 10 pounds, respectively, are being placed on the market by the Fermot Co., 200 Broadway, New York City. They are intended for use in chipping castings; scaling residue from boilers; calking pipes and tanks; scraping paint from various parts; cutting oil-grooves in bearings; drilling concrete floors and ceilings, etc. The hammers are designed only for operation on alternating current. In operation, the shank of the tool is simply inserted in the collar or nose and against a core that is given 7200 strokes per minute. It will be seen from the illustration that a switch is incorporated in the handle. Holes up to 1 inch in diameter can be cut through concrete with the large sized hammer.

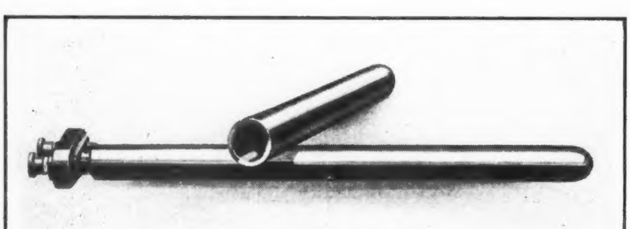


Simbi Portable Electric Hammer

"PYNOLAG" PYROMETER PROTECTION TUBES

Tubes having a wall thickness of only 5/64 inch are being placed on the market by the Louis C. Eitzen Co., 280 Broadway, New York City, for protecting the thermo-couples of pyrometers. These "Pynolag" tubes have a high thermal conductivity, are highly sensitive, and cause little, if any, temperature lag. They are made of rolled sheet metal having a high chromium content. Another advantage mentioned is the resistance of the tubes to corrosion, abrasion, oxidation, and to the destructive influences of reducing gases, mechanical shocks, sudden heat changes, and high temperatures. The tubes are said to give satisfactory constant service at 2100, and satisfactory periodic service at 2300 degrees F.

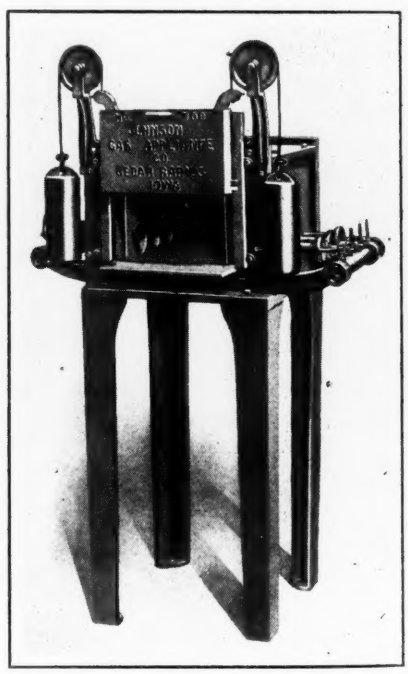
These tubes can be provided with an adjustable flange that permits them to be inserted through a furnace wall to any required distance. Standard tube lengths of 12, 18, 24, 30, and 36 inches are carried in stock, and various outside diameters from 7/8 to 1 7/16 inches.



"Pynolag" Protection Tube for Pyrometer Thermo-couples

JOHNSON FURNACE

A No. 700 oven furnace designed for use in carburizing, hardening, annealing, and similar processes is being placed on the market by the Johnson Gas Appliance Co., Cedar Rapids, Iowa. This furnace is equipped with six direct-jet burners for obtaining any temperature up to 2350 degrees F. without the use of a forced air blast. Shut-off valves on these burners enable a close regulation of the heat. The firebox is lined with firebrick, and measures 7 by 11 by 14 inches. The maximum gas consumption is given as 240 cubic feet per hour.



Johnson Oven Furnace

* * *

According to *Commerce Reports*, conditions in the machinery industry in Germany are very unsatisfactory. The statistics of the German Machinery Manufacturers' Association show that at the end of the year hardly 20 per cent of the plants in the machine-building industry were satisfactorily occupied. The average working week was 44 hours during December, as compared with 52 1/2 hours a week during the first eight months of 1925.

WATCH DOGS!

CINCINNATI
MAKES MORE MACHINE TOOLS IN LARGER VARIETY THAN ANY OTHER CITY IN THE WORLD
TO SEE ANY UP-TO-DATE MACHINE TOOL COME TO
CINCINNATI

Know Your Costs

Dogs control the table movement—*Automatically*. The machine is shown set up for reciprocal milling, the operator has only to load and unload the work—the machine does the rest. This feature is found on all 4 and 5 High Power Cincinnati Millers and also on Cincinnati Automatic Millers. More than twenty different cycles may be obtained simply by different combinations of dogs. Another reason why the operator asks for Cincinnati Millers!

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI · OHIO · U·S·A·

CINCINNATI MILLERS

OBITUARIES

JOHN W. CARLETON

John W. Carleton, superintendent of the Union Mfg. Co., New Britain, Conn., died March 6. He was one of the last surviving mechanics who worked on precision work, such as the rifling of guns, during the Civil War.

Mr. Carleton started to learn his trade in the fifties at the plant of the Davis & Furber Machine Co., manufacturers of textile machinery, at North Andover, Mass. He later completed his apprenticeship at the Amoskeag Works, Manchester, N. H., where at that time, not only textile machinery, but locomotives, stationary steam engines, and fire engines were built. The plant employed 1200 machinists and 300 apprentices. When the Civil War began, this plant engaged in gun making and Mr. Carleton specialized in that field for several years. After the war, he worked for a time on Navy guns at the Charlestown Navy Yard as assistant engineer. He was later employed on government contracts at Glastonbury, Conn., and finally became right-hand man of Richard Lawrence (one of the founders of Robbins & Lawrence), at Sharp's Rifle Factory in Hartford.

On January 1, 1870, he went to the Union Mfg. Co., New Britain, Conn., and remained with this firm up to the time of his death. At first he was in charge of the machine shop department, and in 1894 he became general superintendent, which position he held for more than thirty years. For a long period he designed the various styles of chucks made by the company. In this connection, he visited many of the leading American machine tool concerns, and will be remembered by many of the older generation in these plants. He remained active up to the end of his life, and was at the factory less than a month previous to his death.

While at the Amoskeag Works, he had charge of the testing of steam fire engines, and the association thus early formed with fire department work continued through his long career as fire commissioner and fire chief in New Britain.

With Mr. Carleton passes one of the last of the old-time New England mechanics trained before the days of the Civil War—men who in their apprentice days received a strenuous but thorough schooling in shop practice, and who in their later years displayed a resourcefulness and versatility which enabled them to achieve remarkable results with tools and equipment that were not developed to the present high state of perfection.

HUGH R. MCGREGOR

Hugh R. McGregor, for many years mechanical superintendent of the Brown & Sharpe Mfg. Co., Providence, R. I., died at his home on Armington St., Edgewood, March 18, following a long decline in health which, however, only lately incapacitated him from his work.

Mr. McGregor was born in Brookville, Pictou County, Nova Scotia, March 29, 1859. He came to Providence in 1871 and was first employed in connection with the manufacture of rifles at the plant of the Providence Tool Co., which then was filling a large order for the Turkish Government. After six years with that company, he started a regular apprenticeship with the Brown & Sharpe Mfg. Co. on June 4, 1877, and before he had finished his period of apprenticeship, he was made assistant foreman in the department building milling machines. For five years, between 1893 and 1898, he was connected with the Curtis Electric Co. of Jersey City, N. J., and the Sprague Electric Co. of Bloomfield, N. J. He returned to the Brown & Sharpe Mfg. Co. in March, 1898, and later became mechanical superintendent, a position involving large responsibilities, which he held until about a year ago.

The present line of machine tools and accessories manufactured by the Brown & Sharpe Mfg. Co. was developed under his supervision, and many of these machines and tools bear the impress of his own ideas, especially the line of milling machines. He was one of the oldest of the company's employes in point of service, having actually been with the company for a period of 44 years. His personality was characterized by force of character, loyalty to his work and organization, and ability to produce good work.

Mr. McGregor was keenly interested in the work of the First Presbyterian Church, with which he was connected for forty-five years, and in which he held the office of elder and clerk of the sessions. On September 4, 1880, he married Miss Hannah M. Remington who survives him.

ANDREW C. CAMPBELL, widely known as an inventor and one of the outstanding mechanical experts of the country, died at his home in Waterbury, Conn., in February, aged, sixty-nine years. Mr. Campbell was born in New York City in 1856. He was educated in the public schools of Brooklyn and Dean Academy, Franklin, Mass., and received his early mechanical training with his father who was the inventor of the Campbell printing press. For a number of years Mr. Campbell was associated with the Wheeler & Wilson Sewing Machine Co. of Bridgeport, going from there to the Waterbury Farrel Foundry & Machine Co. in 1889. For sixteen years he was secretary and general manager of the E. J. Manville Machine Co. In 1910 he formed the A. C. Campbell Co. of which he was president. At this period he became associated with the American Chain Co. acting as consulting engineer. Both of these offices he held until the time of his death, although he had retired from active business.

PERSONALS

MARK L. C. WILDE has been appointed manager of the Philadelphia branch—308 N. 15th St.—of the Colonial Steel Co.

MANUEL GRANICH has been added to the sales department of John R. Shays, New York district representative for the Foote Bros. Gear & Machine Co., Chicago, Ill.

WILLIAM A. EDWARDS, branch manager of the Chicago territory for the Ludlum Steel Co., Watervliet, N. Y., has been transferred to Houston, Texas, to take charge of the southwestern territory.

HERMAN CASLER, Canastota, N. Y., is now marketing personally the Casler boring head and the Casler twin screw drill chuck. Mr. Casler is the originator of these two devices and has long been identified with their manufacture.

JOHN K. DESMOND, formerly connected with the Philadelphia district sales office of the Crucible Steel Co. of America, has been appointed Philadelphia district manager of steel sales for Henry Disston & Sons., Inc., Tacony, Philadelphia, Pa.

H. C. OSMAN, sales manager of the Nugent Steel Castings Co., Chicago, Ill., has been elected secretary of the company. He will continue to have charge of sales. C. A MACDONALD, formerly secretary, has been elected treasurer of the company.

WALTER R. CLARK, general works manager of the Bridgeport Brass Co., Bridgeport, Conn., and WARREN D. BLATZ, general sales manager, have recently been elected to the directorate of the company. Both of these men have come up from the ranks.

JOHN V. CALHOUN, formerly engineer of furnace construction with the Combustion Engineering Corporation, New York City, has taken up his new duties as sales manager with Harold E. Trent, Philadelphia, Pa., manufacturer of electrical heating and temperature control appliances.

E. R. FREDERICK, who has been in charge of the New York office of Société Anonyme Andre Citroën, Paris, France, has resigned to engage in other work, and will be succeeded by VICTOR BAUDIN from the Paris office. Correspondence should be addressed to the company at 250 W. 57th St., New York City.

JAMES C. HINES, who was associated for a number of years with the selling organization of the McDonald Machine Co. of Chicago, Ill., is now connected with the E. W. Bliss Co., 53rd St. and Second Ave., Brooklyn, N. Y., and will represent that company in the sales division of the automatic can-making machinery department.

JACOB LUNDGREN, chief engineer in charge of the Olsen-Carwen balancing machine department of the Tinius Olsen Testing Machine Co., 500 N. 12th St., Philadelphia, Pa., sailed for Europe early in March to consult with engineers in various large plants regarding their balancing difficulties and methods of overcoming them. He will be gone for several months.

J. W. BOLTON, metallurgist and director of research of the Frank Foundries Corporation, Davenport, Iowa, spoke on "Relationships Between the Structure and Mechanical Properties of Cast Iron" before the Quad-City Foundrymen's Association at its meeting at the Rock Island Club, Rock Island, Ill., on March 15. Mr. Bolton was chosen by the American Foundrymen's Association to present the International Exchange Paper at the Belgian and French Foundry Congress at the 1925 meeting of the Congress.

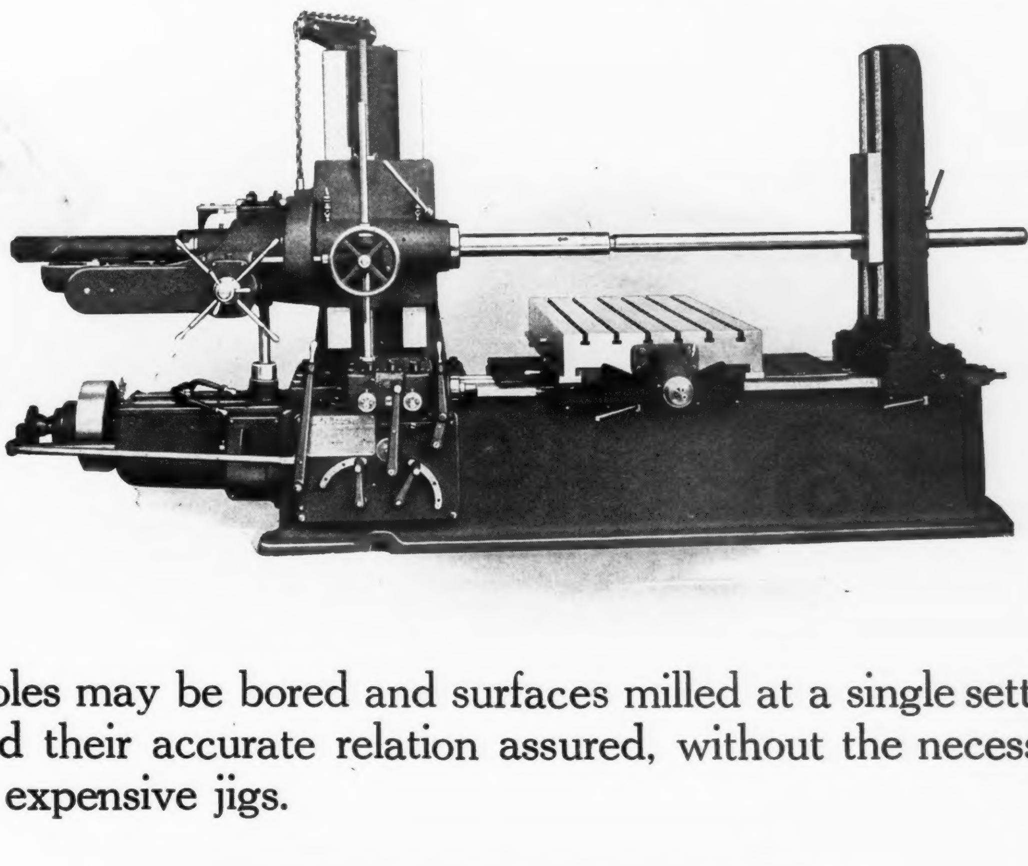
JAMES F. MILLER, who has been simultaneously president and general manager of the Miller-Hurst Corporation, Detroit, Mich., specialist in production methods and equipment for foundries and factories and also president and general manager of the Interstate Foundries, Inc., which operate foundry and machine plants at Cleveland, Ohio, and Clearing, Ill., has resigned from the latter position effective March 1, 1926. After a month's rest Mr. Miller will devote his entire energies to the Miller-Hurst Corporation, of which he was one of the founders.

An Excellent Overflow Machine

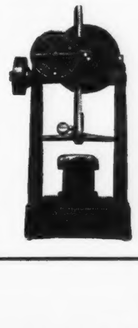
As your boring, milling and drilling departments become crowded, from time to time, take care of the peak load in all of them, successively and successfully with a LUCAS

"PRECISION"

Boring, Drilling and Milling Machine



Holes may be bored and surfaces milled at a single setting and their accurate relation assured, without the necessity of expensive jigs.



WE ALSO MAKE THE

LUCAS POWER

Forcing Press

THE LUCAS MACHINE TOOL CO. NOW AND ALWAYS OF **CLEVELAND, OHIO,** U.S.A.

FOREIGN AGENTS: Alfred Herbert, Ltd., Coventry. Societe Anonyme Belge, Alfred Herbert, Brussels. Allied Machinery Co., Turin, Barcelona, Zurich. V. Lowener, Copenhagen, Oslo, Stockholm. R. S. Stokvis & Zonen, Paris and Rotterdam, Andrews & George Co., Tokyo.

TRADE NOTES

STANLEY P. ROCKWELL CO., Hartford, Conn., announces that the firm is now located in new and larger quarters at 66 Trumbull St.

CENTRAL STEEL CO., Massillon, Ohio, manufacturer of "Agathon" alloy steels, has opened a district sales office at 404 W. First St., Tulsa, Okla.

HENRY DISSTON & SONS, INC., Tacony, Philadelphia, Pa., have opened a new service branch and warehouse at Detroit, Mich., where a complete stock of Disston steels, saws, files, and machine knives will be carried.

ARBITRATION SOCIETY OF AMERICA, INC., ARBITRATION FOUNDATION, INC., and ARBITRATION CONFERENCE announce their consolidation into the AMERICAN ARBITRATION ASSOCIATION, 342 Madison Ave., New York City.

HOYT E. BATTEY, 220 Broadway, New York City, has taken over the printers' tool business founded in 1865 by O. W. Bullock, his great-uncle. Mr. Battey obtained his training in the Bullock Mfg. Associates plant at Springfield, Mass.

C. V. REGRINDING WORKS, Harrison Ave., Chambersburg, Pa., has changed its name to RENUL PARTS CO. There has been no change in the management. This concern is engaged in general automotive machine work and repair work.

AJAX ELECTROTHERMIC CORPORATION, Trenton, N. J., has acquired a twenty-five-acre tract of land in Ewing Township on which it will erect a new factory, 200 by 60 feet, together with a two-story office building, containing about 4000 square feet of floor space.

FEDERAL MACHINE & GEAR CO., 1754 E. 47th St., Cleveland, Ohio, engaged in engineering and contract machine work, has changed its name to FEDERAL GEAR, INC. The officers of the concern are F. C. Clough, president; H. L. Stinard, vice-president; A. B. Betz, treasurer, and R. Edwards, secretary.

JOHN B. STEVENS, INC., 27 Cleveland Place, New York City, has purchased the entire line of milling machines and attachments formerly made by the Garvin Machine Co., and will continue the manufacture of these machines. The milling machine line includes plain, universal, vertical, and automatic index millers.

TAFT-PEIRCE MFG. CO., Woonsocket, R. I., in connection with the rearrangement of its plant for more efficient operation, has just purchased the following new equipment: one nibbling machine, two shapers, one 9-inch precision lathe, one 16-inch geared-head precision lathe, one jig boring machine, and one band saw.

THE PATTERSON TOOL & SUPPLY CO. of Dayton, Ohio, through the error of a local journal, was recently quoted as a "unit" of another organization, although this company, which was established in 1881, has always been an independent organization and the owners have no intention of combining with any other concern.

MITCHELL ENGINEERING CO., Springfield, Ohio, manufacturer of floor grinders and other types of grinding equipment, is now also making the line of special threading and tapping machines formerly built by the Webster & Perks Tool Co. This line of machines will be marketed through the Chadwick Co., 549 W. Washington St., Chicago, Ill.

KINGSBURY MFG. CO., Keene, N. H., manufacturer of automatic drilling machinery, has appointed the Syracuse Supply Co. exclusive representative of the company in the Syracuse, Rochester, and Buffalo territories. The Millholland Sales & Engineering Co., of Indianapolis, has been appointed exclusive representative in the Indiana territory.

ROCKFORD MILLING MACHINE CO., Rockford, Ill., has appointed the Cleveland Duplex Machinery Co. of Cleveland, Ohio, exclusive dealer in the Cleveland territory for Rockford millers and Sundstrand lathes. The Rockford Tool Co. has appointed the Seifreat-Elstad Machinery Co. of Dayton, Columbus, and Cincinnati exclusive representative in the territory referred to for Sundstrand lathes.

HENRY DISSTON & SONS, INC., Tacony, Philadelphia, Pa., have added a machine knife manufacturing department to their factory at Sixth and Baymiller Sts., Cincinnati, Ohio. This branch factory will serve users of Disston machine knives in the Middle West and parts of the South. Complete hardening and tempering equipment, and machinery for grinding and beveling high-speed planer knives of all sizes have been installed.

CENTRAL STEEL CO., Massillon, Ohio, has made the following changes in the officers of the company, due to the death of R. E. Bebb, who was chairman of the board of directors for many years: F. J. Griffiths is now chairman of the board of directors; C. E. Stuart has been made president and treasurer; B. F. Fairless, vice-president and general manager; J. M. Schlendorf, vice-president in charge of sales, and Charles C. Chase, Jr., secretary.

CUTLER-HAMMER MFG. CO., Milwaukee, Wis., has opened a new sales office in the Healey Building, Atlanta, Ga. This office will take care of the trade in the states of North and South Carolina, in the eastern section of Tennessee, Georgia, Florida, southern Alabama and Mississippi. A. C. Gibson, formerly of the Philadelphia office, is in charge. The General Machinery Co. of Birmingham, Ala., will continue to serve the trade in the northern half of Alabama.

FOSTER BOLT & NUT MFG. CO., Cleveland, Ohio, has just completed an additional building to its Cleveland plant. This, in addition to another building, erection of which will begin July 1, will considerably increase the capacity of the main plant. The company is also building a new plant of modern type at Chicago, Ill., which is expected to be in operation by May 1. These new facilities will enable the company to handle its growing business advantageously.

ALLIS-CHALMERS (FRANCE) is an organization recently incorporated in France, with headquarters at 3 Rue Taitbout, Paris, to handle the business of the Allis-Chalmers Mfg. Co. in continental Europe. H. I. Keen, who has been manager of European sales through the company's district office in Paris, will be the managing director of the new organization. The company has maintained for many years an office in London at 728 Salisbury House, London Wall, E. C. 2.

DODGE MFG. CORPORATION, Mishawaka, Ind., has taken over the entire business and personnel of the Hugh P. Robbins organization of Chicago, and has created a new division of the general sales and engineering departments known as the material handling division. Hugh P. Robbins has been made head of the new division. The company has recently announced a new line of plain bearing belt conveyor idlers as well as a Dodge-Timken roller bearing conveyor idler. A full line of portable, pan and gravity conveyors will also be manufactured.

CENTURY ELECTRIC CO., 1806 Pine St., St. Louis, Mo., manufacturer of alternating-current motors and fans, announces that the company has just purchased an eight-acre factory site, located on a branch of the Wabash Railroad, at Spring Ave., Forest Park Boulevard, and Manchester Ave., St. Louis, on which it will erect buildings for manufacturing purposes and warehouses. The factories now located on both sides of Pine St. between 18th and 19th Sts., the southeast corner of 19th at Olive St., and the warehouse at 21st and Poplar Sts., will still be occupied.

LEE & CLARK has recently been incorporated to take over the business previously conducted as a partnership under the name of the JAMES T. LEE CO. The company specializes in hydraulic equipment, plate working tools, metal-working machinery, pumps, car wheel borers, pipe benders, flexible steam joints, etc. Offices are maintained at 549 W. Washington Blvd., Chicago, Ill. James T. Lee is president of the new organization, and John O. Clark is vice-president. Mr. Lee was formerly vice-president of the Hanna Engineering Works, Chicago, Ill., and for the last five years has been western manager of the Southwark Foundry & Machine Co. Mr. Clark was sales manager of the Hanna Engineering Works for a number of years.

MANNING, MAXWELL & MOORE, INC., 100 E. 42nd St., New York City, have purchased the name, good will, drawings, patterns, etc., of the DETRICK & HARVEY MACHINE CO., Baltimore, Md., and will continue the development and manufacture of the Detrick & Harvey line, particularly open-side and convertible planers, standard double-housing planers and horizontal boring machines. This work will be carried on at the plant of the Putnam Machine Works at Fitchburg, Mass., a subsidiary of Manning, Maxwell & Moore, Inc. J. W. Neidhardt, who has been president of the Detrick & Harvey Machine Co., will be associated with Manning, Maxwell & Moore, Inc., specializing in the Detrick & Harvey line. The present plant, machinery, and equipment of the Detrick & Harvey Machine Co. will be liquidated in the near future.

METAL MOLD CASTINGS CO., INC., 212 Winchester Ave., Buffalo, N. Y., has been formed to manufacture permanent mold aluminum castings. The corporation has purchased, by stock transfer, the assets of the BRONZO ALUMINA CORPORATION, of Buffalo, one of the first manufacturers of permanent mold aluminum castings in the country. The new company has taken over the plant of the older concern at 212 Winchester Ave., the plant having been remodeled for greater efficiency. The capacity of the plant is 5000 pounds of aluminum castings per day, fifty men being employed. In addition to its permanent mold foundry, the company operates a complete mold-making department for the manufacture of metal molds for its own use, and polishing and machine departments for the finishing of the castings made. The president of the new company is Theodore H. Pickering, formerly foundry manager of Josiah Anstice & Co., Rochester, N. Y. J. Ernest Kauffmann is vice-president and chief engineer. Mr. Kauffmann has been president of the Bronzo Alumina Corporation since its incorporation. Eames Donaldson is secretary, treasurer, and sales manager. He has also been associated with the Bronzo Alumina Corporation for the last six years.

COMING EVENTS

APRIL 6-8—Third annual convention and exposition of the American Oil Burner Association in Detroit, Mich. Headquarters, Book-Cadillac Hotel. Executive secretary, Leod D. Becker, 350 Madison Ave., New York City.

APRIL 15-16—Twenty-eighth convention of the National Metal Trades Association, to be held at the Hotel Astor, New York City. J. E. Nyhan, National Secretary, Peoples Gas Bldg., Chicago, Ill.

APRIL 21-23—Annual meeting of the American Welding Society at the headquarters of the society, 33 W. 39th St., New York City.

APRIL 28-30—Thirteenth annual convention of the National Foreign Trade Council in Charleston, S. C. Secretary, O. K. Davis, India House, Hanover Square, New York City.

MAY 3-6—Regional meeting of the American Society of Mechanical Engineers at Providence, R. I. Luther D. Burlingame, Brown & Sharpe Mfg. Co., Providence, R. I., chairman of the local committee. Calvin W. Rice, 29 W. 39th St., New York City, secretary of the society.

MAY 13-15—Annual meeting of the American Gear Manufacturers' Association in Detroit, Mich. Headquarters, Book-Cadillac Hotel; secretary, T. W. Owen, 2443 Prospect St., Cleveland, Ohio.

JUNE 1-4—Semi-annual meeting of the Society of Automotive Engineers at French Lick Springs, Ind. Coker F. Clarkson, 29 W. 39th St., New York City, secretary.

JUNE 16-18—Thirteenth national convention of the Society of Industrial Engineers to be held at the Bellevue-Stratford Hotel, Philadelphia, Pa. The keynote of the convention will be "Practical Methods for Eliminating Waste." George C. Dent, executive secretary, 608 S. Dearborn St., Chicago, Ill.

JUNE 19-26—Convention and exhibit of the Mechanical Division, American Railway Association, Young Million Dollar Pier, Atlantic City, N. J. Secretary of the Mechanical Division: V. R. Hawthorne, 431 S. Dearborn St., Chicago, Ill. Secretary-treasurer of the exhibit: J. D. Conway, 1841 Oliver Bldg., Pittsburg, Pa.

JUNE 21-25—Twenty-ninth annual meeting of the American Society for Testing Materials at the Chalfonte-Haddon Hall Hotel, Atlantic City, N. J. Secretary's address, 1315 Spruce St., Philadelphia, Pa.

JUNE 28-July 1—Spring meeting of the American Society of Mechanical Engineers at San Francisco, Cal. Warren H. McBryde, California & Hawaiian Sugar Refining Corporation, 215 Market St., San Francisco, Cal., chairman of the local committee. Calvin W. Rice, 29 W. 39th St., New York City, secretary of the society.

JULY 1-SEPTEMBER 15—International Exhibition for Inland Navigation and Utilization of Hydraulic Power, at Basle, Switzerland. For further information apply to Organizing Secretary, International Exhibition, Basle V, Switzerland, or to the Swiss Federal Railroads, 241 Fifth Ave., New York City.

SEPTEMBER 20-24—Eighth annual convention and exposition of the American Society for Steel Treating to be held at the Municipal Pier, Chicago, Ill. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

SEPTEMBER 27-OCTOBER 2—Annual convention of the American Foundrymen's Association and second international foundry congress in Detroit, Mich. In conjunction with these conventions there will be held an international exposition of foundry and machine shop equipment and supplies. C. E. Hoyt, secretary-treasurer, 140 S. Dearborn St., Chicago, Ill.

OCTOBER 2-10—Southern exposition to be held in the New Madison Square Garden, Eighth Ave. and 49th St., New York City. W. G. Sirrine, president of the exposition, New Madison Square Garden, New York City.

SOCIETIES, SCHOOLS AND COLLEGES

UNIVERSITY OF MISSOURI, Rolla, Mo. Catalogue 1925-1926 of the school of mines and metallurgy.

DREXEL INSTITUTE, Philadelphia, Pa. Catalogue for 1926-1927, covering the courses offered by the institute in engineering, home economics, secretarial science, business administration, and library science.

NORTHEASTERN UNIVERSITY, Boston Young Men's Christian Association, Boston, Mass. Catalogue of the school of engineering for 1926-1927. Catalogue of the day school of business administration for 1926-1927.

NEW BOOKS AND PAMPHLETS

INDUCTIVE HEATING. By E. F. Northrup, scientific head of the Ajax Electrothermic Corporation, Trenton, N. J. 24 pages, 6¾ by 9½ inches.

A REVIEW OF RAILWAY OPERATIONS IN 1925. 32 pages, 6 by 9 inches. Published by the Bureau of Railway Economics, Washington, D. C., as Pamphlet No. 38 of the Miscellaneous Series.

RESEARCH IN CONCRETE. By W. K. Hatt. 102 pages, 6 by 9 inches. Published by Purdue University, Lafayette, Ind., as Bulletin No. 24 of the Engineering Experiment Station.

KILOCYCLE-METER CONVERSION TABLE. Chart, 11 by 15½ inches. Published by the Department of Commerce, Washington, D. C., as Miscellaneous Publication No. 67 of the Bureau of Standards. Price, 5 cents.

AN INVESTIGATION OF THE FATIGUE OF METALS. By H. F. Moore and T. M. Jasper. 92 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 152 of the Engineering Experiment Station. Price, 50 cents.

THERMAL EXPANSION OF TUNGSTEN. By Peter Hidnert and W. T. Sweeney. 5 pages, 7 by 10 inches. Published by the Department of Commerce, Washington, D. C., as Scientific Paper No. 515 of the Bureau of Standards. Price, 5 cents.

COMMERCIAL CARBURETER CHARACTERISTICS. By C. S. Kegerreis, Opie Chenoweth, and M. J. Zucrow. 115 pages, 6 by 9 inches. Published by Purdue University, Lafayette, Ind., as Bulletin No. 21 of the Engineering Experiment Station.

AN INVESTIGATION OF CERTAIN METHODS FOR TESTING HEAT INSULATORS. By E. F. Grundhofer. 72 pages, 6 by 9 inches. Published by the Pennsylvania State College, State College, Pa., as Bulletin No. 33 of the Engineering Experiment Station.

HISTORY OF THE STANDARD WEIGHTS AND MEASURES OF THE UNITED STATES. By Louis A. Fischer. 34 pages, 7 by 10 inches. Published by the Department of Commerce, Washington, D. C., as Miscellaneous Publication No. 64 of the Bureau of Standards.

ELECTRIC TRUCK CHARGING STATIONS IN NEW YORK AND VICINITY. Published by the New York Edison Co., 130 E. 15th St., New York City. Distributed free of charge from the automobile bureau of the New York Edison Co., or from any of the company's district offices.

PROCEEDINGS OF THE THIRTEENTH ANNUAL CONVENTION OF THE AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION. 178 pages, 5½ by 8½ inches. Published by the American Railway Tool Foremen's Association, 11402 Calumet Ave., Chicago, Ill. Price, $2.50.

TALES OF DISCOVERY, INVENTION, AND RESEARCH. VOL. II. 174 pages, 5 by 7½ inches. Collected by the Engineering Foundation, 29 W. 39th St., New York City, and published by the Williams & Wilkins Co., Baltimore, Md. Price, $[illegible]

This is the second volume of a series on Popular Research Narratives, and contains fifty brief stories of research, invention, or discovery told by the "men who did it." The book is written in a readable style, easily understood by those without scientific training.

PROCEEDINGS OF THE TWENTY-EIGHTH ANNUAL MEETING OF THE AMERICAN SOCIETY FOR TESTING MATERIALS. Published by the society, 1315 Spruce St., Philadelphia, Pa. Arranged in two parts; price of each part, paper-bound, $6; cloth-bound, $6.50; half leather binding, $8.

Part I (962 pages, 6 by 9 inches) contains the annual reports of thirty-five of the standing committees of the society, together with the discussion of these reports. Part II (454 pages, 6 by 9 inches) contains twenty-six technical papers, with discussion, covering the subjects of fatigue of metals, effect of temperature on the properties of metals; and investigations on the corrosion of metals; cement and concrete; stability of bituminous mixtures; paint, gypsum, brick, textiles, etc.

NEW CATALOGUES AND CIRCULARS

DILATOMETERS. Stanley P. Rockwell Co., 66 Trumbull St., Hartford, Conn. Bulletin 2602, descriptive of the Volcrit method of heat-treatment by the Rockwell dilatometer.

SEPARATOR MAGNETS. Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, Ohio. Leaflet on the use and methods of installing E. C. & M. separator magnets.

ELECTRIC STARTERS. Allen-Bradley Co., Milwaukee, Wis. Bulletin 215, descriptive of type C-1220 current-limit automatic direct-current starters for machine tool service or similar applications.

POWER HAMMERS. Barbour-Stockwell Co, 205 Broadway, Cambridge, Mass. Catalogue illustrating and describing Dupont power hammers. Complete specifications are given for both the belt and motor-driven styles.

WRENCHES. J. H. Williams & Co., Buffalo, N. Y. Booklet A-81, containing a complete list of Williams drop-forged wrenches, as well as useful wrench specification data. Copies will be sent to those interested, upon request.

GEAR GRINDING MACHINES. Lees-Bradner Co., Cleveland, Ohio. Circular 42, illustrating and describing the Lees-Bradner gear grinding machine and its application in the manufacture of automobile transmission gears.

AUTOMATIC MACHINERY. Baird Machine Co., Bridgeport, Conn. Circular illustrating Baird automatic four-slide wire and ribbon metal forming machine; ball burnishing machine; heavy pattern press, and double tilting tumbler.

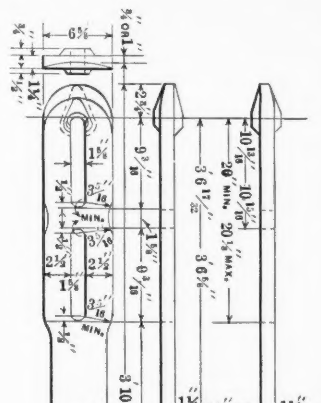
COUNTERBORES AND HOLDERS. The Gairing Tool Co., Inc., Detroit, Mich. Supplement No. 18-1 to Catalogue Series No. 18, illustrating and describing Gairing type C plain holders for counterbores, type C cutters, and type C pilots.

POWER DRIVE. Borden Co., Warren, Ohio. Circular illustrating and describing the No. 44 "Beaver" power drive for use in connection with pipe threading and cutting tools. Specific figures are given regarding the savings effected by the power drive.

PORTABLE ELECTRIC TOOLS. Hisey-Wolf Machine Co., Cincinnati, Ohio. Catalogue 32, covering the Hisey line of portable electric tools. Among the other products described in this catalogue is a new Hisey double-slide angle-plate grinder.

CORK PLATES FOR MACHINE INSTALLATIONS. Korfund Co., Inc., 11 Waverly Place, New York City. Circular entitled "How to Isolate Machine Vibrations," describing the use of Korfund cork plates for absorbing vibrations in machinery.

AJAX



WITH 21 years of service to its credit, this 5″ Ajax Upsetting Forging Machine is still going strong. Over this long period it has made a great variety of forgings; at present it is reinforcing the eyes of steel draw bar yokes for freight cars to increase the bearing area for the draft pin.

This machine is one of fourteen Ajaxs in this car shop, installed over a period of 21 years; a most convincing testimony of satisfactory service.

Dependability day in and day out, and *durability* to stand the gaff of heavy work year after year are two reasons for the predominance of Ajax Machines in all large forging machine installations.

Bulletins describing the construction features which have stood the test of years of service will be mailed you upon request.

THE AJAX MANUFACTURING COMPANY, EUCLID, OHIO

OFFICES: CHICAGO, ILL., 621 Marquette Bldg.; NEW YORK CITY, 1369 Hudson Terminal

PYROMETER PROTECTION TUBES. Industrial Welded Products Co., Newark, N. J. (Louis C. Eitzen Co., 280 Broadway, New York City, general sales agent). Leaflet descriptive of "Pynolag" pyrometer protection tubes for thermo-couples.

GRINDING MACHINES. Blanchard Machine Co., 64 State St., Cambridge, Mass. Circular on Blanchard grinding machines, illustrating examples of the classes of work for which this machine is adapted and giving production time on a typical job.

HARDENING EQUIPMENT. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Circular entitled "Exact Hardening with Simple Equipment," dealing with the Hump method of hardening, and showing Hump electric hardening furnaces and equipment.

SPEED REDUCERS, COUPLINGS, HOISTS, ETC. W. C. Lipe, Inc., 208 S. Geddes St., Syracuse, N. Y. Catalogue illustrating and describing Lipe products, including speed reducers, flexible couplings, electric hoists, pulleys, gear-tooth rounding machines, and coil winders.

ELECTRIC FITTINGS. Crouse-Hinds Co., Syracuse, N. Y. Bulletin 2086, descriptive of safety "Arktite" plugs and receptacles, interlocking switches and plugs, and safety hand lamps. Bulletin 2085, containing data on condulets for grounding service wire and conduit system.

GEARS. Grant Gear Works, 2nd and B Sts., South Boston, Mass. Catalogue for 1926, containing lists of iron cut gears, brass cut gears, and cast gears. The pamphlet also contains tabular matter relating to gearing, such as tables of diametral and circular pitch, bevel gear chart, etc.

DRILL JIGS AND FIXTURES. Universal Standard Sales Co., 500 Murphy Building (Woodward at Grand), Detroit, Mich. Catalogue descriptive of "Quick-Clamp" rapid-production or interchangeable drill jigs and fixtures, adapted for both single and multiple-spindle drilling of parts.

PUNCHES, DIES, AND TOOLS. George F. Marchant Co., 1420 S. Rockwell St., Chicago, Ill. Pamphlet giving data on the line of punches and dies, punch couplings, rivet sets, rivet heads, etc., made by this concern. These tools are made to recognized standards which are listed in the pamphlet.

LOCATING AND JIG BORING MACHINE. Societe Genevoise d'Instruments de Physique, Geneva, Switzerland (United States representative, R. Y. Ferner Co., Investment Bldg., Washington, D. C.). Catalogue 420, illustrating and describing in detail three sizes of high-precision locating and jig boring machines. Examples of the time saved with these machines are also given.

SAWS, FILES, AND MACHINE KNIVES. Ohlen-Bishop Co., Columbus, Ohio. Catalogue 10, covering the complete line of saws, files, and machine knives made by this concern. Dimensions and prices are given for the various products, and considerable general information, such as care of saws, guards for saws, care and grinding of knives, suggestions for ordering, etc., is included.

TURRET LATHES. International Machine Tool Co., Indianapolis, Ind. Catalogue of "Libby-International" turret lathes. In addition to a detailed description of the construction of the lathes and their various parts, condensed data is given for the different sizes. The catalogue also contains tool suggestions, including descriptions and illustrations of standard chucking tools, standard bar tools, and general-purpose tools.

THREADING DIE-HEADS. Geometric Tool Co., New Haven, Conn., is distributing a pamphlet on the subject of thread standardization, descriptive of a movement to simplify practice in cutting screw threads by standardization of the sizes of die-head chasers. The pamphlet lists all sizes of chasers regularly carried in stock, all other sizes being furnished at an extra charge covering the expense incidental to manufacturing in small quantities.

SMALL TOOLS. Brown & Sharpe Mfg. Co., Providence, R. I. Small tool catalogue No. 30, covering the complete line of over 2000 small tools made by this concern. The catalogue lists several new tools and cutters that have been added to the line since the previous edition of the small tool catalogue was issued. New material has also been added on special work, special gages, the correct use of tools under actual shop conditions, as well as a number of new reference tables.

THREADING DIE-HEADS. Eastern Machine Screw Corporation, Truman and Barclay Sts., New Haven, Conn. Pamphlet entitled "Thread Standardization," containing tables of standard thread sizes based on recommendations made by the Department of Commerce, Division of Simplified Practice, and the National Thread Commission appointed by Congress. The pamphlet states that in the future H. & G. chasers will only be put in stock for thread sizes shown in the tables in this folder, other sizes being made to order only.

KNIFE GRINDERS AND SAW SHARPENERS. Samuel C. Rogers & Co., 10 Lock St., Buffalo, N. Y. Illustrated 16-page price list, covering this company's full line of automatic knife grinders and saw sharpeners. Two additions to the line are shown in this circular, namely, a low-priced thin knife grinder and an improved circular saw sharpener driven by motor from a lamp socket. It is stated that the company is now equipped to furnish almost its entire line of grinders with direct motor drive.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. General Catalogue 6001B, containing 1100 pages, 8 by 10 inches, covering the complete line of electrical equipment made by the company. The catalogue is thumb-indexed into sixteen sections as follows: Generation, wire and cable, distribution transformers, arresters, voltage regulators, switchboards and accessories, switchboard devices, meters and instruments, motors, motor applications, industrial control, railway, lighting, industrial heating, miscellaneous, and indexes. Publication GEA-355, entitled "Some Developments in the Electrical Industry during 1925," containing a review of various phases of electrical application and the outstanding developments during the year.

TURRET LATHES. Warner & Swasey Co., Cleveland, Ohio, has just brought out the first of a series of pamphlets on "Modern Tooling Methods for Turret Lathes." The first booklet is on bar work, and this will be followed by two booklets on chucking work. The aim of the series is to explain clearly how production can be increased by the use of the best methods for turret lathe tooling, due consideration being given to the difference in the methods best suited for small lot and for quantity lot production. The first chapter of the book discusses the problems of the individual shop and makes suggestions for increasing production through multiple cuts, combined cuts, and rigid tooling. The second chapter discusses the problems of bar work, and shows a number of typical bar tool lay-outs, illustrating the principles of increased production. The design of individual tools is then treated, and the possibilities of developing a universal tooling equipment for bar work are shown. The illustrations are accompanied by full production data.

MECHANICS SOCIETY COMPLETES ONE-HUNDRED AND FORTIETH YEAR

The General Society of Mechanics and Tradesmen of the City of New York (with headquarters at Mechanics Institute, 16 W. 44th St., New York City) has just completed its 140th year, having been organized in 1785. This society was a continuation, in modified form, of the kind of institutions that grew up with the development of the mechanic arts in England and which were known by the general name of "Guilds." Its membership is made up of mechanics or tradesmen who are citizens of the United States. The purpose of the society is educational and benevolent. It offers free instruction to young men, during the evening, in architectural and mechanical drafting, free-hand drawing, mathematics—both elementary and advanced—physics, and industrial electricity. This society has had considerable influence during the formative period of our country; in 1810 it secured a charter for the Mechanics Bank—the fourth bank in New York (now the Mechanics and Metals National Bank)—and in 1820, it established the first free library and reading room in New York. It also maintained the first free course of lectures. A school was established in 1820, out of which grew the school of today, providing free technical instruction to young men working during the day.

TEST ON DOUBLE-ACTING DIESEL ENGINE

A thirty-day endurance test was recently completed by a marine double-acting Diesel engine built by the Worthington Pump & Machinery Corporation, 115 Broadway, New York City, at the company's works in Buffalo. During the endurance test, which began February 2 and continued until March 4, the engine operated at a load of about 2900 brake horsepower and at a speed of 95 revolutions per minute. At the end of the thirty-day period, the load was increased 10 per cent, without stopping the engine, for a period of six hours, and then for a further period of four hours, the speed was increased 5 per cent, producing an overload both in load and speed. The double-acting two-cycle principle employed in this engine simplifies the reversing. Complete reversal from full load in one direction to full load in the opposite direction can be made in six seconds, and twenty-eight consecutive reversals were made during the test at an average time of 8 1/2 seconds each. Forty reversals were made in one hour. After the test, the engine was shut down for 17 hours and was then started up instantly without even priming the fuel valves. The engine was built for the United States Shipping Board, and complete test data will be available as soon as it is released by the board.